LEAD

PRODUCTS

NATIONAL LEAD COMPANY
722 Chestnut Street St. Louis, Mo.

LEAD
PRODUCTS

NATIONAL LEAD COMPANY

NEW YORK
111 Broadway

BALTIMORE
214 W. Henrietta St.

BUFFALO
116 Oak St.

CHICAGO
900 West 18th St.

CINCINNATI
659 Freeman Ave.

CLEVELAND
1213 W. Third St.

ST. LOUIS
722 Chestnut St.

ATLANTA
Georgia Lead Works
Bishop & MeCaslin Sts.

BOSTON
National-Boston Lead Co.
800 Albany St.

PHILADELPHIA
John T. Lewis & Bros. Co.
Widener Bldg.

PITTSBURGH
National Lead & Oil Co. of Pa
316 Fourth Ave.

THE DUTCH BOY TRADE-MARK

The original portrait of the Dutch Boy, reproduced above, was painted in 1907 by Lawrence Carmichael Earle. Mr. Earle, who died in 1921, was a distinguished portrait and character painter. His Dutch Boy is admired by art critics as a boy portrait of unusual merit.

To the American buying public, the Dutch Boy is a familiar figure. He has appeared in the national advertising and on many of the products of National Lead Company for more than a quarter of a century. Everywhere he is recognized as a symbol of quality and reliability.

THE USES OF LEAD

Men have used lead for a variety of purposes since the very earliest times. Every one of its familiar physical properties—color, weight, permanence, ease of working—has proved of practical value in one direction or another.

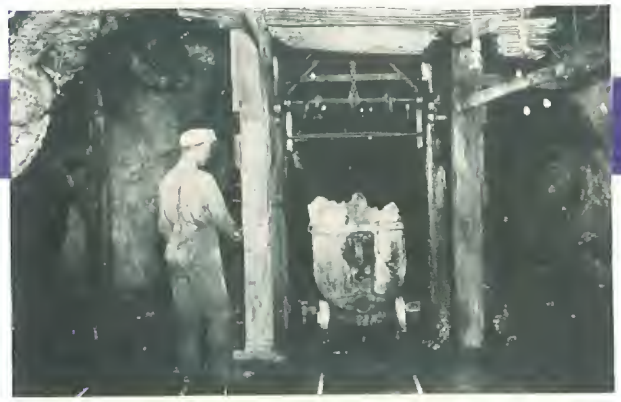
In the modern world, there is an ever-widening circle of uses for lead. In many instances, its less well-known characteristics, such as electrical and lubricating properties or the ability to absorb sound and radiant energy, are brought into play. Notable examples are the use of lead in lubricants, for anodes in plating processes, for protection against X-Ray or radium emanations, or its use in steel to increase machineability.

This catalog was prepared in the belief that many of the properties and uses of lead are not generally known. While primarily a buyer's guide, it may help also to introduce the reader to other ways in which lead can serve him.

NATIONAL LEAD COMPANY

National Lead Company mines and smelts lead and is the largest manufacturer of lead products in the world. In addition to metallic lead and lead alloy products, it makes and sells a full line of paint materials as well as the dry lead pigments employed in various industrial processes. For many years, it has been the chief source of supply for a large section of American trade and industry.

National Lead Company maintains factories, warehouses or sales offices in many cities of the United States as shown on the map on the following page. An inquiry or an order addressed to the nearest sales office will receive prompt and courteous attention.



Mining

Smelting

Manufacturing

Research

OFFICES, PLANTS, AND WAREHOUSES OF NATIONAL LEAD COMPANY

METAL DIVISION

LEAD PIPE

for water service and plumbing

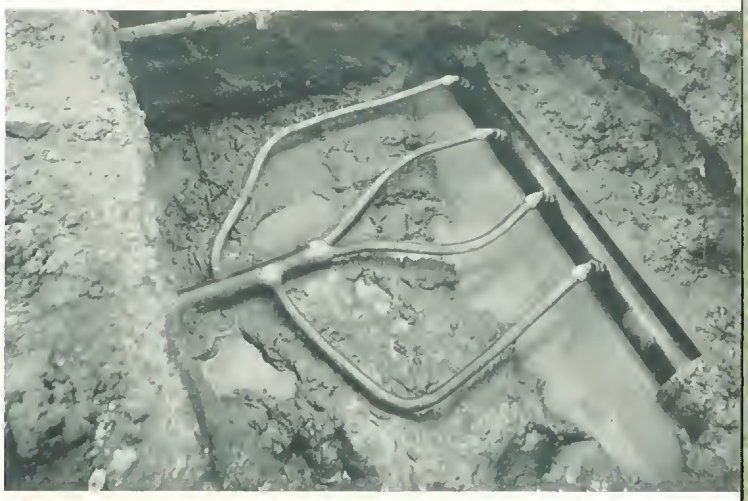
Lead pipe is widely used for water service and the waste and vent systems in plumbing. Among those responsible for the installation of such systems—water works engineers and the plumbing trade generally—lead pipe has long been recognized as ideal for the purpose.

For the underground piping which connects a residence or building with the water main, lead pipe has many advantages to recommend it. It resists soil corrosion and is less subject to perforation. Having smooth interior walls and a high hydraulic efficiency, it offers a minimum of resistance to water flow. Being pliant and flexible, it adjusts itself to ground settlement and, if the water freezes, is less likely to burst because it can expand slightly with the expanding water.

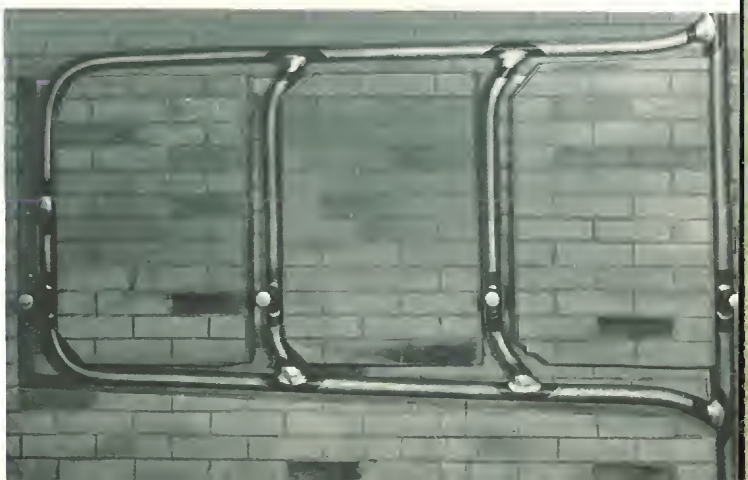
For the supply and waste systems inside a building, lead pipe is equally advantageous. Furnished in long continuous lengths, it is readily bent around corners and obstacles making fewer joints necessary. Frequent joints tend to impede water flow. Being flexible, lead pipe is less likely to be damaged by vibration or building settlement. Furthermore, lead pipe does not clog from rusting,

ADVANTAGES OF LEAD PIPE

1. **Durable**
   Lead pipe lasts indefinitely.
2. **Flexible**
   Lead pipe is flexible . . . adjusts itself to building or ground settlement.
3. **Fewer Joints Needed**
   Lead pipe comes in long, continuous lengths . . . is readily bent around corners and obstacles. There are thus fewer joints to impede water flow.
4. **Less Trouble From Freeze-Ups**
   Freeze-ups are less likely to burst lead pipe. It expands with the expanding water.
5. **Hydraulic Efficiency**
   Lead pipe offers less resistance to water flow than other types of metal pipe.
6. **Non-Rusting**
   Lead does not rust. Therefore lead pipe never clogs from this cause.
7. **Non-Staining**
   Water flowing through lead pipe does not discolor . . . will not stain expensive bath or kitchen fixtures.
8. **Corrosion-Resistant**
   Lead pipe resists soil corrosion as well as the action of many acids and chemicals.
9. **High Salvage Value**
   Discarded lead installations have a high scrap value.
10. **Low Cost Per Year**
    The exceptional durability of lead pipe makes its cost per year of service lower than that of pipe made from any other material.



Above: *Typical lead water service showing themultiple tapping method employed when a large service is connected to a small main.* Below: *Lead roughing-in for a battery of four lavatories.*



nor does it discolor water leading to the staining of expensive fixtures.

Many building codes require the use of lead pipe for the waste and vent systems. This is a sanitary precaution based on the proven dependability of lead pipe—its record in countless installations of trouble-free service year in and year out.

Above: *Uncoiling lead pipe in a trench before attaching to water main.* Below: *Bending lead pipe. Note the bending spring inserted in the pipe.* Right: *A graphic illustration of lead's flexibility and the advantage taken of it by a skilled plumber.*

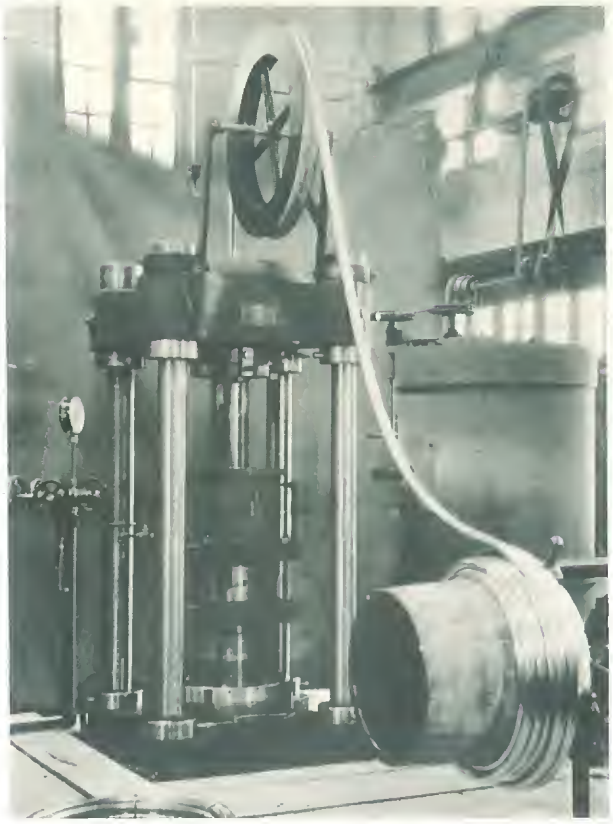
MANUFACTURE OF LEAD PIPE

Our lead pipe—sold under the Dutch Boy trademark—is manufactured by the extrusion process in modern hydraulic presses. In this process, the lead, at a carefully regulated temperature, is forced under heavy pressure through a die and around a core to form continuous lengths of seamless, smooth-bore pipe.

Only standard accepted brands of refined lead are used. Only skilled operators handle the presses. The result is lead pipe of the highest quality which can be depended upon to be uniform in wall thickness, of the correct weight per foot and free from imperfections which cause structural weakness.

SIZES AND WEIGHTS

Due to the nature of the extrusion process, lead pipe can be produced in a wide range of diameters and weights. A selected list of sizes is given on the second page following. This list conforms to the national standard of lead pipe sizes and weights



Left: *Modern hydraulic press extruding seamless, smooth-bore lead pipe.* Above: *This photo shows the marking which appears on lead pipe sold under the Dutch Boy trademark.* Below: *Coils of lead pipe before and after packing for shipment.*

approved by the Lead Industries Association and adopted by most lead pipe manufacturers.

An outstanding feature of the approved list is that all sizes of pipe in the A, AA, and AAA classifications will safely withstand constant cold water pressures as follows:

A (or "Strong")	50 lbs.
AA (or "Extra Strong")	75 lbs.
AAA (or "Double Extra Strong")	100 lbs.

Heretofore, the safe working pressures of these classes of pipe often decreased as the diameter increased.

MARKING

All lead pipe shown on the accompanying list in sizes from ½″ I.D. to 2″ I.D., whether coiled or in lengths, is stamped as shown in the photograph above. This stamping, which includes the Lead Industries Association "Seal of Approval" and the National Lead Company name and trademark, appears approximately every thirteen inches. The I.D. and weight per foot are stamped on one end.

PACKING

Pipe, ⅜″ I.D. to 1″ I.D., and heavy wall pipe, 1¼″ I.D. to 2″ I.D., are shipped in coils, wrapped in straw and either burlap or heavy paper.

Light wall pipe, 1¼″ I.D. to 2″ I.D., and pipe above 2″ I.D., are shipped in 10-foot lengths, unless otherwise specified.

Pipe, ⅜″ I.D. to 2″ I.D., is also furnished on reels. There is an extra charge for the reel which is refunded when the reel is returned.

LEAD PIPE SIZES AND WEIGHTS

The sizes and weights given in this table are those approved by the Lead Industries Association as standard for plumbing purposes.

Lead pipe in other weights and in sizes up to and including 12" I.D. can be furnished on short notice.

SIZE I.D.	CLASSIFICATION EAST	CLASSIFICATION WEST	SIZE O.D.	WGT. PER FT. LBS.	WGT. PER FT. OZS.
3/8"	E	AQ	.520		8
	D	XL	.549		10
	C	L	.577		12
	B	M	.631	1	
	A	S	.725	1	8
	AA	XS	.811	2	
	AAA	XXS	.888	2	8
1/2"	E	AQ	.628		9
	D	XL	.666		12
	C	L	.712	1	
	B	M	.756	1	4
	A	S	.798	1	8
	AA	XS	.876	2	
	AAA	XXS	1.012	3	
5/8"	E	AQ	.765		12
	D	XL	.803	1	
	C	L	.881	1	8
	B	M	.953	2	
	A	S	1.019	2	8
	AA	XS	1.082	3	
	AAA	XXS	1.137	3	8
3/4"	E	AQ	.906	1	
	D	XL	.940	1	4
	C	L	1.006	1	12
	B	M	1.068	2	4
	A	S	1.156	3	
	AA	XS	1.212	3	8
	AAA	XXS	1.336	4	12
1"	E	AQ	1.192	1	10
	D	XL	1.232	2	
	C	L	1.284	2	8
	B	M	1.356	3	4
	A	S	1.428	4	
	AA	XS	1.492	4	12
	AAA	XXS	1.596	6	
1 1/4"	E	AQ	1.442	2	
	D	XL	1.486	2	8
	C	L	1.528	3	
	B	M	1.592	3	12
	A	S	1.670	4	12
	AA	XS	1.765	6	
	AAA	XXS	1.889	7	12
1 1/2"	E	AQ	1.740	3	
	D	XL	1.776	3	8
	C	L	1.830	4	4
	B	M	1.882	5	
	A	S	1.984	6	8
	AA	XS	2.076	8	
	AAA	XXS	2.272	11	4
1 3/4"	D	XL	2.024	4	
	C	L	2.086	5	
	B	M	2.146	6	
	A	S	2.193	6	12
	AA	XS	2.404	10	8
	AAA	XXS	2.624	14	12
2"	E	AQ	2.185	3	
	D	XL	2.284	4	12
	C	L	2.354	6	
	B	M	2.410	7	
	A	S	2.503	8	12
	AA	XS	2.751	13	12
	AAA	XXS	3.008	19	8
2 1/2"			2.75	5	
			3.00	10	10
3"			3.25	6	
			3.50	12	8
4"			4.25	7	14
			4.50	16	6
5"			5.25	9	14
			5.50	20	4
6"			6.25	11	13
			6.50	24	2

LEAD PIPE

for handling corrosive chemicals

Lead piping is standard equipment in industrial plants where the manufacturing process involves the use of corrosive chemicals or gases. Typical large users are the oil refineries, metal refineries, acid plants, chemical companies, pulp and paper mills, rayon plants and the like.

The special property of lead pipe which makes it virtually indispensable in industrial equipment is corrosion resistance. Its outstanding use, because of this property, is in the manufacture and transportation of sulphuric acid. However, lead pipe has been and is being used successfully to handle a large number of other industrial chemicals and gases, often under severe service and temperature conditions.

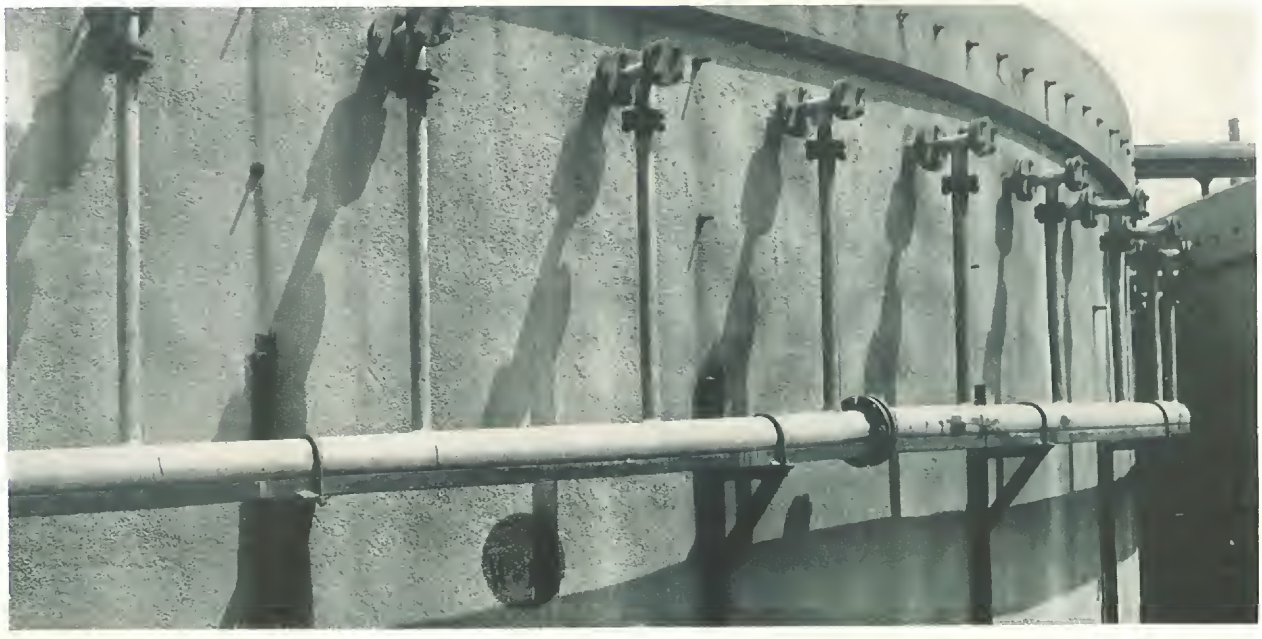
In addition to corrosion resistance, the pliability of lead pipe is an advantage in chemical equipment. It allows easy-working, such as bending, and the fabrication of the pipe into coils or other special apparatus.

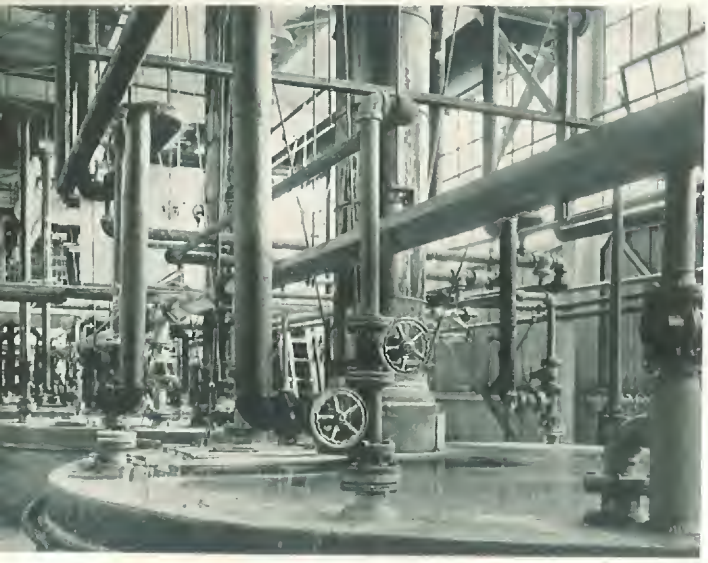
Since the cost of extruding lead pipe is not high, a major portion of the initial cost is for the metal itself. Thus discarded lead piping has a high scrap value, an economy factor which should not be overlooked when purchasing pipe.

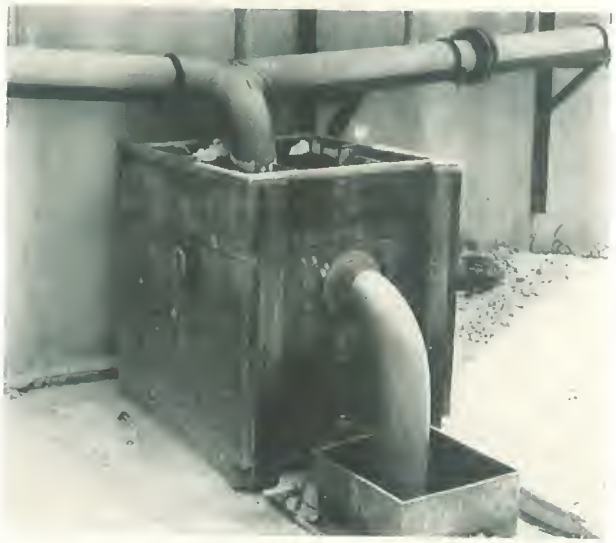
GRADES OF LEAD PIPE

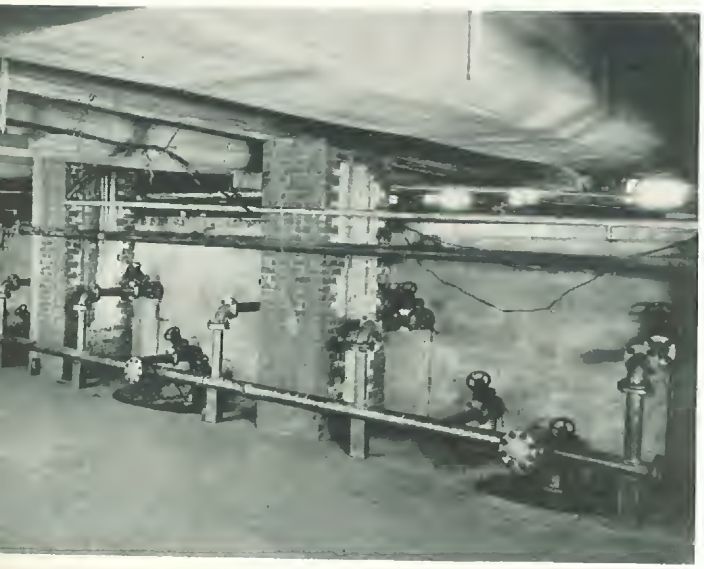
Several types of lead pipe are available for industrial use. All are made either of chemical lead or of chemical lead to which small amounts

Above: *Lead pipe line for handling a salt solution. Pipes are insulated to facilitate temperature control.* Below: *Discharge pipe on the outside of a circular concrete settling tank.*









of other metals have been added to induce hardness, higher acid-resistance under certain conditions, or some other desirable property. The term "chemical lead" refers to a grade of undesilverized lead containing small amounts of copper and nickel which practical experience has shown possesses unusual anti-corrosive properties.

The various types of lead pipe available differ greatly in mechanical strength, resistance to corrosion and other physical properties. If there is no previous service record to guide the selection for a particular installation, the industrial engineer should first determine, by means of tests or by consultation with the technical staff of National Lead Company, the most suitable type to use.

TELLURIUM LEAD PIPE*

This grade of pipe is made from prime chemical lead to which a small quantity of tellurium has been added. The addition is in the amount indicated by our extensive research on this alloy.

Lead containing tellurium has several outstanding properties. One is an improved corrosion resistance, particularly at the higher temperatures. Another is the capacity to work-harden. Tellurium lead—toughened by bending, stretching or hammering—actually has a greater tensile strength than before. Still a third property is a greatly improved resistance to failure under vibratory stresses.

Tellurium lead pipe installations are successfully cutting costs in many industrial and chemical plants. A plating concern recently reported that heating coils fabricated from tellurium lead lasted 100 per cent longer than the coils used previously. A chemical concern reported that a tellurium lead pipe line carrying alum liquor at 90°C. had performed satisfactorily for three years, whereas the type of pipe formerly used twisted and bulged after three months' service.

*Pat. No. 2,060,534

Top: *Lead piping in connection with a battery of digestors in a large industrial plant.* Center: *Another view of the lead discharge pipe shown on the preceding page. The solution empties into a drain protected with sheet lead.* Bottom: *Lead pipe line connecting a series of lead-lined acid mixing and storage tanks.*

TELLURIUM-ANTIMONIAL LEAD PIPE

Tellurium lead pipe is also available alloyed with any specified antimonial content. As with straight antimonial lead pipe, the standard is 6 per cent, and this alloy will be supplied unless otherwise specified.

OTHER GRADES

Chemical Lead Pipe: Chemical lead pipe is made only from standard accepted brands of prime lead which conform to Grade II of the A. S. T. M. standard specifications (B29-35).

Antimonial Lead Pipe: Antimonial lead pipe is made from prime chemical lead, alloyed with any specified antimony content up to 10 per cent. Most pipe of this grade contains 6 per cent antimony which is standard in many plants.

Tin-Lined Lead Pipe: This grade, used principally in brewing equipment, is made from pure chemical lead with an adherent tin lining. Stock sizes are $\frac{3}{8}$" I.D. (10 ozs. per foot) and $\frac{1}{2}$" I.D. (12 ozs. per foot). Other sizes can be made quickly on order.

SIZES AND WEIGHTS

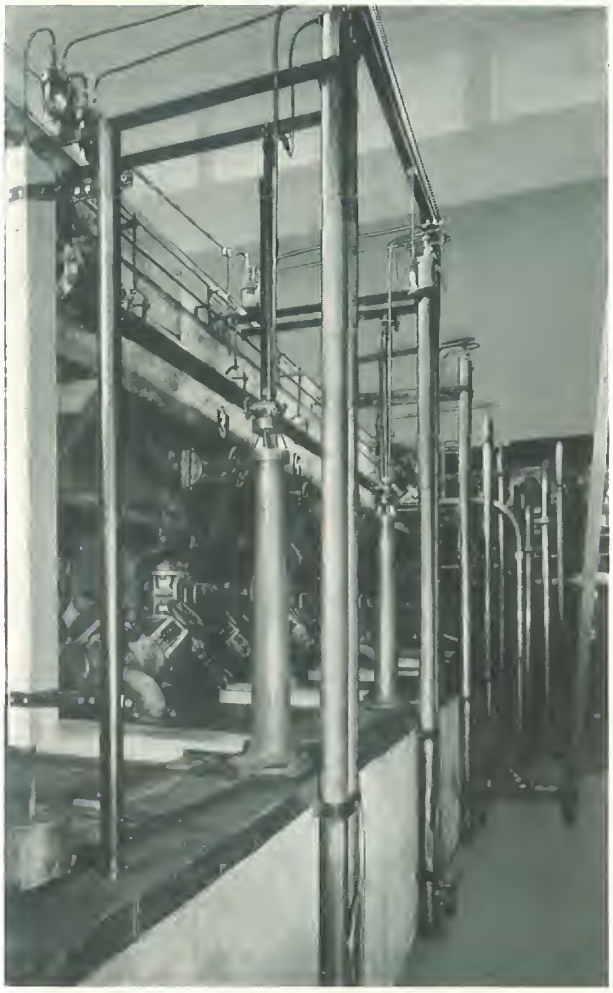
Lead pipe, manufactured by National Lead Company, is made in a wide range of sizes and weights to fit every industrial need. A list of many commonly used sizes and weights is given on pages B-5 and B-6 following. All our pipe is guaranteed to be of the exact composition specified, to be true in size and weight and free from structural defects.

PACKING

Pipe, $\frac{3}{8}$" I.D. to 1" I.D., and heavy wall pipe, $1\frac{1}{4}$" I.D. to 2" I.D., are shipped in coils, wrapped in straw and either burlap or heavy paper.

Light wall pipe, $1\frac{1}{4}$" I.D. to 2" I.D., and pipe above 2" I.D., are shipped in 10-foot lengths, unless otherwise specified.

Pipe, $\frac{1}{2}$" I.D. to 2" I.D., is also furnished on reels.



Top: *A battery of lead-lined acid mixing tanks, together with the lead piping and lead-lined valves necessary to supply the system.* Bottom: *Six per cent antimonial flanged pipe and fittings fabricated at one of our plants for a southern paper company. The total shipment weighed more than 26 tons.*

LEAD PIPE SIZES AND WEIGHTS (Continued)

Size I.D.	Size O.D.	App. Wgt. per Ft. Lbs.	Ozs.
3½"	3.665	4	8
	3.68	5	
	3.71	6	
	3.75	7	8
	3.87	9	8
	4.00	15	
	4.12	18	
	4.25	22	
	4.37	26	10
	4.50	30	
4"	4.18	5	
	4.20	6	
	4.25	7	14
	4.30	10	
	4.37	12	8
	4.50	16	0
	4.65	21	
	4.75	25	
	4.84	30	
	5.00	34	12
4½"	4.71	8	
	4.75	9	
	4.81	11	
	4.87	14	
	5.00	18	
	5.11	22	
	5.25	26	
	5.374	33	
	5.50	38	
5"	5.10	8	
	5.25	9	14
	5.31	12	
	5.37	15	
	5.50	20	4
	5.62	25	
	5.75	31	
	5.87	37	
	6.00	42	
5½"	5.66	10	
	5.75	12	
	5.87	16	
	6.00	21	
	6.12	26	
	6.25	32	
	6.37	40	
	6.50	46	
6"	6.25	11	13
	6.37	18	
	6.50	24	2
	6.62	30	
	6.75	37	
	6.87	44	
	7.00	50	
6½"	6.75	12	12
	6.87	19	8
	7.00	25	
6½"	7.124	33	
	7.25	40	
	7.374	47	
	7.50	54	
7"	7.25	15	
	7.37	22	
	7.50	28	
	7.624	37	
	7.75	46	
	7.87	50	
	8.00	58	
7½"	7.75	14	12
	7.87	22	
	8.00	30	
	8.12	38	
	8.25	46	
	8.37	54	
	8.50	62	
8"	8.25	18	
	8.37	23	12
	8.50	32	
	8.62	40	
	8.75	50	
	9.00	65	
8½"	8.75	16	12
	9.00	34	
	9.12	43	
	9.37	60	
	9.50	65	
9"	9.37	26	8
	9.50	36	
	9.62	47	
	9.75	56	
	10.00	73	
9½"	9.75	18	8
	10.00	38	
	10.25	57	
	10.37	67	
	10.50	77	
10"	10.25	20	
	10.37	30	
	10.50	40	
	10.62	54	
	10.75	62	
	10.87	71	
	11.00	81	
11"	11.50	42	
	12.00	89	
12"	12.37	35	
	12.50	48	
	12.62	60	
	12.75	72	
	13.00	97	

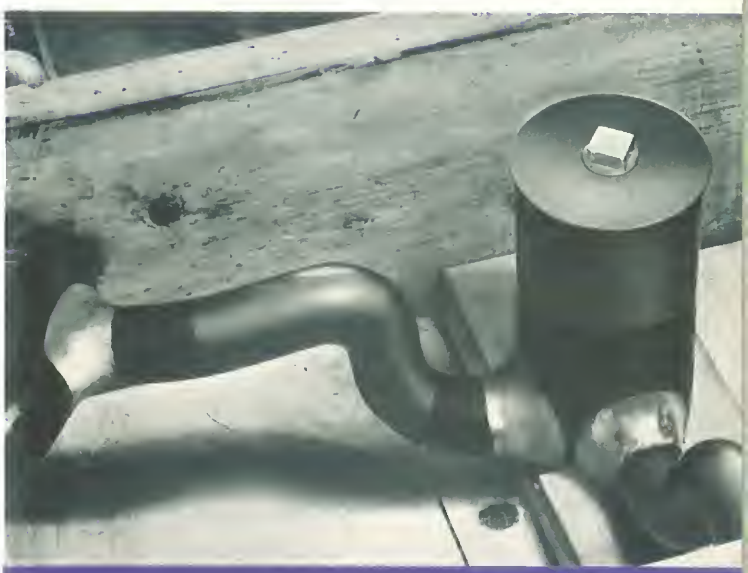
LEAD FITTINGS

As shown on the following pages, we manufacture a full line of lead fittings and accessories for use in plumbing systems. The line includes traps of various designs in all standard patterns, short, long, and extension bends, combination ferrules, combination bends and ferrules and soldering nipples of various types.

In addition to these products which are stock items and can be supplied on short notice, we also manufacture closed-end bends and ferrules used by plumbers to test their roughing-in work, deep seal traps and ground joint vented traps, the special traps used in the Southern and New England districts, and lead or lead alloy fittings in special sizes, shapes and weights according to specification.

Our plumbing accessories can be depended upon to be of the highest quality in every respect. They are made from pure, refined lead only. The accuracy of our dies and the care and skill of our workmen insure correct shape and a uniform wall thickness throughout. Where a national weight standardization exists, such as in traps and bends, each product is stamped individually with the Lead Industries' "Seal of Approval," as well as with our name and trademark, and the size and weight.

To facilitate ordering, we have given as complete data as possible on the following pages. These include prices, details of construction, suggestions for ordering, methods of packing and price list for extras when differing from regular specifications. Any other information will gladly be furnished on request.



Top: *Lead drum trap with inlet and outlet connections wiped on. Note that both connections are made near the base of the trap at right angles, giving water in the trap a swirling, and thus a cleaning motion.* Center: *Lead bends and piping for a battery of five wall-hung closets. "Chairs," similar to the one under the center bend, will be installed under the others for the permanent support of the closets.* Bottom: *Lead "P" trap with vent connection under a shower pan. A section of the pan has been cut away to show the installation.*

LEAD TRAPS

Our lead traps are carefully made from the best grade of pure refined lead. They are extruded under high pressure, insuring a smooth interior and uniformity in wall thickness throughout the entire length.

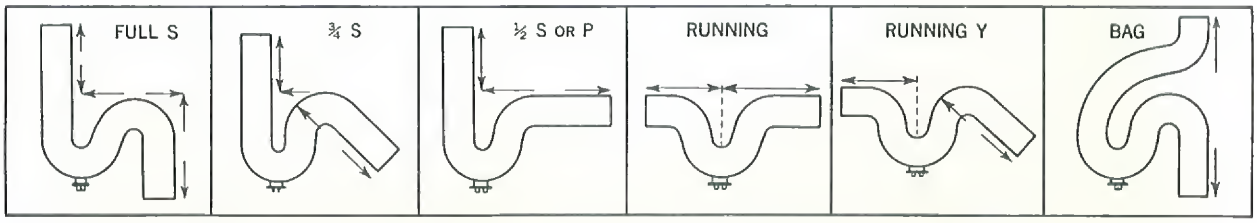
Lead traps in all the standard styles and sizes come either vented or unvented. Extra long designs in all sizes are furnished with either long inlet or long outlet.

In ordering drain traps, specify style, inside diameter and weight division. State whether vented or unvented is desired. Unless otherwise specified "standard weight" unvented will be furnished.

In ordering extra long traps, specify whether long inlet or long outlet is desired.

DIMENSION SCALE FOR REGULAR TRAPS

Note: *Dimensions are taken on inlet, outlet, length over all and from center to ends.*



Size	Full S		¾ S		½ S or P		Running		Running Y		Bag
	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Length Over All
1¼"	4¼"	6¼"	4¼"	5¼"	4½"	6"	4½"	5½"	4½"	5¼"	11½"
1½"	4½"	7"	4½"	6"	4½"	7"	5¼"	6¼"	5¼"	6"	13"
2"	4½"	8"	4½"	7½"	4½"	8"	5¼"	7½"	5¼"	7½"	15"
3"	4"	10½"	4"	10"	4"	9½"	7½"	7½"	7½"	10"	18½"
4"	3¼"	11½"	3¼"	11"	3¼"	10"	8"	8"	8"	11"	22½"

DIMENSION SCALE FOR EXTRA LONG TRAPS

Note: *Dimensions are taken as shown by arrows on illustrations of regular traps above.*

Size	Full S	¾ S		½ S or P		Running		Running Y		Bag
	Length Over All	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet	Length Over All
1¼"	24"	4¼"	16¼"	4¼"	14¼"	4½"	17½"	4½"	16¼"	24"
1½"	24"	4½"	15¾"	4½"	14"	5¼"	16¾"	5¼"	15¾"	24"
2"	24"	4¼"	15½"	4½"	14"	5¼"	16¾"	5¼"	15½"	24"

REGULAR AND EXTRA LONG TRAPS

U. S. STANDARD PRICE LIST

	Standard (Lightest) Weight					Special (Medium) Weight			Extra Heavy Weight				
Weight in Lbs. Per Running Foot	1½	2¼	3¼	5	6	2	3	4	2½	3½	4½	6	8
Diameter—Inches	1¼	1½	2	3	4	1¼	1½	2	1¼	1½	2	3	4
Full S —Regular	$0.58	$0.90	$1.38	$2.69	$3.25	$0.73	$1.03	$1.65	$0.87	$1.25	$1.85	$3.09	$4.30
—Extra Long	.93	1.36	2.00			1.19	1.64	2.40	1.44	1.95	2.69		
¾ S —Regular	.55	.81	1.30	2.62	3.07	.66	.94	1.53	.81	1.15	1.73	2.97	3.95
—Extra Long	.85	1.19	1.76			1.04	1.43	2.08	1.28	1.72	2.33		
½ S or P —Regular	.51	.75	1.20	2.24	2.49	.64	.87	1.42	.77	1.09	1.57	2.58	3.25
—Extra Long	.76	1.02	1.55			.95	1.22	1.83	1.14	1.50	2.02	3.25	
Running —Regular	.48	.72	1.13	2.09	2.53	.58	.87	1.32	.70	1.03	1.46	2.35	3.28
—Extra Long	.82	1.15	1.67			1.01	1.41	1.98	1.23	1.65	2.18		
Running Y—Regular	.52	.76	1.34	2.46	3.15	.65	.94	1.45	.74	1.09	1.61	2.88	4.05
—Extra Long	.83	1.15	1.82			1.05	1.45	2.01	1.23	1.52	2.23		
Bag —Regular	.68	1.08	1.73	3.35	4.77	.87	1.28	2.08	1.06	1.54	2.33	3.96	6.30
—Extra Long	1.09	1.58	2.34			1.38	1.91	2.80	1.67	2.24	3.11		

REGULAR AND EXTRA LONG VENTED TRAPS

U. S. STANDARD PRICE LIST

	Standard (Lightest) Weight						Special (Medium) Weight				Extra Heavy Weight					
Weight in Lbs. Per Running Ft.	1½	2¼	3¼		5	6	2	3	4		2½	3½	4½		6	8
Diameter—Inches	1¼	1½	2*		3	4	1¼	1½	2*		1¼	1½	2*		3	4
Vent Size—Inches	1¼	1½	1½	2	2	2	1¼	1½	1½	2	1¼	1½	1½	2	2	2
Full S —Regular	$1.38	$1.85	$2.33	$2.63	$3.94	$4.50	$1.53	$1.98	$2.60	$2.90	$1.67	$2.20	$2.80	$3.10	$4.34	$5.55
—Extra Long	1.73	2.31	2.95	3.25			1.99	2.59	3.35	3.65	2.24	2.90	3.64	3.94		
¾ S —Regular	1.35	1.76	2.25	2.55	3.87	4.32	1.46	1.89	2.48	2.78	1.61	2.10	2.68	2.98	4.22	5.20
—Extra Long	1.65	2.14	2.71	3.01			1.84	2.38	3.03	3.33	2.08	2.67	3.28	3.58		
½ S or P —Regular	1.31	1.70	2.15	2.45	3.49	3.74	1.44	1.82	2.37	2.67	1.57	2.04	2.52	2.82	3.83	4.50
—Extra Long	1.56	1.97	2.50	2.80			1.75	2.17	2.78	3.08	1.94	2.45	2.97	3.27		
Running —Regular	1.28	1.67	2.08	2.38	3.34	3.78	1.38	1.82	2.27	2.57	1.50	1.98	2.41	2.71	3.60	4.53
—Extra Long	1.62	2.10	2.62	2.92			1.81	2.36	2.93	3.23	2.03	2.60	3.13	3.43		
Running Y—Regular	1.32	1.71	2.29	2.59	3.71	4.40	1.45	1.89	2.40	2.70	1.54	2.04	2.56	2.86	4.13	5.30
—Extra Long	1.63	2.10	2.77	3.07			1.85	2.40	2.96	3.26	2.03	2.47	3.18	3.48		
Bag —Regular	1.48	2.03	2.68	2.98	4.60	6.02	1.67	2.23	3.03	3.33	1.86	2.49	3.28	3.58	5.21	7.55
—Extra Long	1.89	2.53	3.29	3.59			2.18	2.86	3.75	4.05	2.47	3.19	4.06	4.36		

*2″ traps have 1½″ vent connections unless otherwise specified.
For nickel plating on 1¼″ and 1½″ vents, add 75 cents to list price; on 2″ vents, add $1.00.

STOCK PACKAGES OF LEAD TRAPS

	1¼″		1½″		2″		3″		4″
	Plain	Vented	Plain	Vented	Plain	Vented	Plain	Vented	Plain
A Barrel of Full S Contains	75	50	50	36	24	20	10	8	6
A Barrel of ¾ S Contains	75	50	50	36	24	20	10	8	6
A Barrel of ½ S or P Contains	75	50	50	36	24	20	12	12	8
A Barrel of Running Contains	100	60	72	50	36	24	12	12	8
A Barrel of Running Y Contains	75	30	50	24	24				
A Barrel of Bag Contains	50	30	36	24	18				

Stock packages of extra long traps contain approximately 30 1¼″, 25 1½″ and 20 2″.

ULCO NON-SIPHON LEAD TRAPS

Ulco Non-Siphon traps are made of drawn lead. Both the inlet and outlet are extruded as is the ball or anti-siphoning feature which is then spun to size and lead-burned in place. These traps are ruggedly constructed and highly efficient.

In ordering, specify size, style and weight division. The dimension scale for these traps is the same as for regular traps.

PRICE LIST

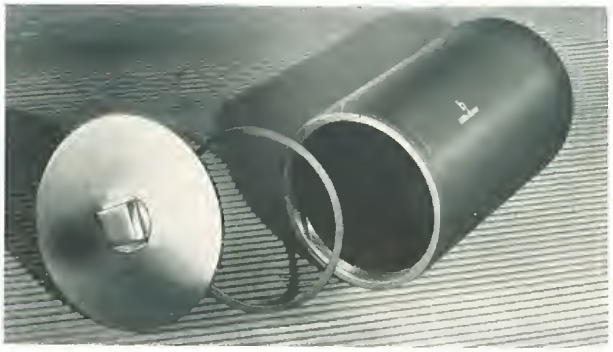
ULCO NON-SIPHON LEAD TRAPS

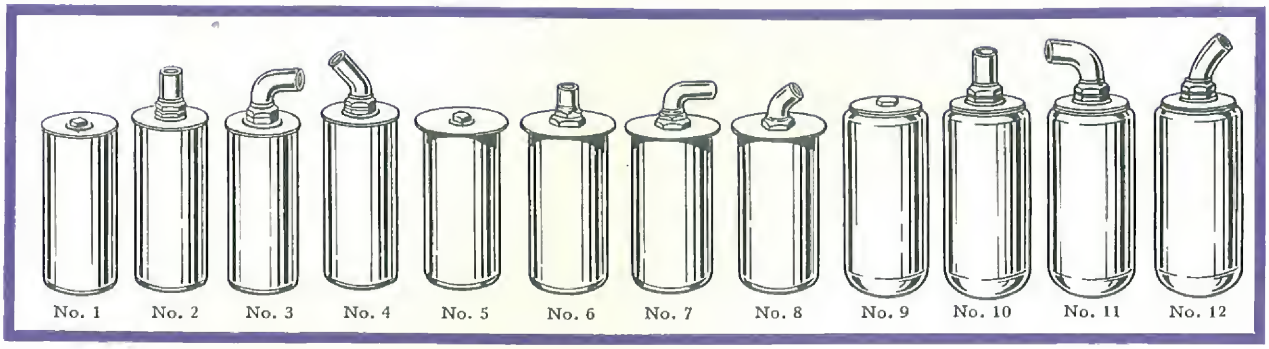
	Standard Weight			Medium Weight			Extra Heavy Weight		
Weight In Lbs. Per Running Foot	1½	2¼	3¼	2	3	4	2½	3½	4½
Size	1¼"	1½"	2"	1¼"	1½"	2"	1¼"	1½"	2"
Full S	$1.95	$2.25	$3.10	$2.10	$2.40	$3.35	$2.25	$2.60	$3.55
¾ S	1.90	2.20	3.00	2.10	2.30	3.25	2.20	2.50	3.45
½ S or P	1.85	2.10	2.90	2.00	2.20	3.15	2.15	2.45	3.30
Running	1.85	2.10	2.90	2.00	2.20	3.15	2.15	2.45	3.30
Full S—Long Inlet No. 1	2.30	2.70	3.70	2.55	3.00	4.10	2.80	3.30	4.40
Full S—Long Outlet No. 2	2.30	2.70	3.70	2.55	3.00	4.10	2.80	3.30	4.40
¾ S—Long Inlet No. 11	2.20	2.55	3.50	2.40	2.80	3.80	2.65	3.10	4.05
¾ S—Long Outlet No. 12	2.20	2.55	3.50	2.40	2.80	3.80	2.65	3.10	4.05
½ S or P—Long Inlet No. 3	2.10	2.40	3.25	2.30	2.60	3.55	2.50	2.90	3.75
½ S or P—Long Outlet No. 4	2.10	2.40	3.25	2.30	2.60	3.55	2.50	2.90	3.75

DRUM TRAPS

Our drum traps are made from pure, refined lead, drawn and then spun to insure a smooth, seamless wall of uniform thickness. They are furnished in a variety of patterns with screws of either plain brass, polished brass, nickel-plated or chromium-plated finishes.

In ordering drum traps, state the style by number, the weight division, diameter and length of body and the screw finish.





DRUM TRAPS

U. S. STANDARD PRICE LIST

Drum Traps Complete (Screws Ordinary Finish)*	Regular Pattern							New England Pattern			Drum Traps Without Screws
	No. 1	No. 2	Nos. 3 & 4	No. 5	No. 5½	No. 6	Nos. 7 & 8	No. 9	No. 10	Nos. 11 & 12	
4 x 8 Standard Weight	$1.90	$2.60	$3.00	$2.00	$2.10	$2.80	$3.20	$1.90	$2.60	$3.00	$0.90
4 x 9 Standard Weight	2.02	2.72	3.12	2.12	2.22	2.92	3.32	2.02	2.72	3.12	1.02
4 x 10 Standard Weight	2.10	2.80	3.20	2.20	2.30	3.00	3.40	2.10	2.80	3.20	1.10
4 x 11 Standard Weight	2.18	2.88	3.28	2.28	2.38	3.08	3.48	2.18	2.88	3.28	1.18
4 x 12 Standard Weight	2.25	2.95	3.35	2.35	2.45	3.15	3.55	2.25	2.95	3.35	1.25
4 x 14 Standard Weight	2.55	3.25	3.65	2.65	2.75	3.45	3.85	2.55	3.25	3.65	1.55
5 x 10 Standard Weight	3.00	3.70	4.10	3.10	3.20	3.90	4.30	3.00	3.70	4.10	2 00
5 x 11 Standard Weight	3.15	3.85	4.25	3.25	3.35	4.05	4.45	3.15	3.85	4.25	2.15
5 x 12 Standard Weight	3.30	4.00	4.40	3.40	3.50	4.20	4.60	3.30	4.00	4.40	2.30
6 x 10 Standard Weight	3.55	4.25	4.65	3.65	3.75	4.45	4.85	3.55	4.25	4.65	2.55
6 x 11 Standard Weight	3.75	4.45	4.85	3.85	3.95	4.65	5.05	3.75	4.45	4.85	2.75
6 x 12 Standard Weight	3.90	4.60	5.00	4.00	4.10	4.80	5.20	3.90	4.60	5.00	2.90
4 x 8 Special Weight	2.05	2.75	3.15	2.15	2.25	2.95	3.35	2.05	2.75	3.15	1.05
4 x 9 Special Weight	2.18	2.88	3.28	2.28	2.38	3.08	3.48	2.18	2.88	3.28	1.18
4 x 10 Special Weight	2.27	2.97	3.37	2.37	2.47	3.17	3.57	2.27	2.97	3.37	1.27
4 x 11 Special Weight	2.37	3.07	3.47	2.47	2.57	3.27	3.67	2.37	3.07	3.47	1.37
4 x 12 Special Weight	2.45	3.15	3.55	2.55	2.65	3.35	3.75	2.45	3.15	3.55	1.45
4 x 14 Special Weight	2.75	3.45	3.85	2.85	2.95	3.65	4.05	2.75	3.45	3.85	1.75
4 x 8 Extra Heavy Weight	2.40	3.10	3.50	2.50	2.60	3.30	3.70	2.40	3.10	3.50	1.40
4 x 9 Extra Heavy Weight	2.50	3.20	3.60	2.60	2.70	3.40	3.80	2.50	3.20	3.60	1.50
4 x 10 Extra Heavy Weight	2.63	3.33	3.73	2.73	2.83	3.53	3.93	2.63	3.33	3.73	1.63
4 x 11 Extra Heavy Weight	2.75	3.45	3.85	2.85	2.95	3.65	4.05	2.75	3.45	3.85	1.75
4 x 12 Extra Heavy Weight	2.90	3.60	4.00	3.00	3.10	3.80	4.20	2.90	3.60	4.00	1.90
4 x 14 Extra Heavy Weight	3.30	4.00	4.40	3.40	3.50	4.20	4.60	3.30	4.00	4.40	2.30
5 x 10 Extra Heavy Weight	3.40	4.10	4.50	3.50	3.60	4.30	4.70	3.40	4.10	4.50	2.40
5 x 11 Extra Heavy Weight	3.55	4.25	4.65	3.65	3.75	4.45	4.85	3.55	4.25	4.65	2.55
5 x 12 Extra Heavy Weight	3.70	4.40	4.80	3.80	3.90	4.60	5.00	3.70	4.40	4.80	2.70
6 x 10 Extra Heavy Weight	4.15	4.85	5.25	4.25	4.35	5.05	5.45	4.15	4.85	5.25	3.15
6 x 11 Extra Heavy Weight	4.35	5.05	5.45	4.45	4.55	5.25	5.65	4.35	5.05	5.45	3.35
6 x 12 Extra Heavy Weight	4.60	5.30	5.70	4.70	4.80	5.50	5.90	4.60	5.30	5.70	3.60
*For polished brass, nickel plated or chromium plated screw finishes, add	.20	.30	.30	.20	.25	.30	.30				

DRUM TRAP ACCESSORIES

Price of Screws	No. 1	No. 2	Nos. 3 & 4	No. 5	No. 5½	No. 6	Nos. 7 & 8
Drum Trap Screws—Ordinary Finish	$1.00	$1.70	$2.10	$1.10	$1.20	$1.90	$2.30
Drum Trap Screws—Nickel or Chromium Plated	1.20	2.00	2.40	1.30	1.45	2.20	2.60
Details of Screws							
Outside Diameter of Cap—Face	4 1/8"	4 1/8"	4 1/8"	4 1/2"	5"	4 1/2"	4 1/2"
Outside Diameter of Cap—Threads	3 3/4"	3 3/4"	3 3/4"	3 3/4"	3 3/4"	3 3/4"	3 3/4"
Inside Diameter of Ring	3 11/16"	3 11/16"	3 11/16"	3 11/16"	3 11/16"	3 11/16"	3 11/16"
Number of Threads to Inch	16	16	16	16	16	16	16
Flange Extends Beyond Body				3/16"	3/16"	3/16"	5/16"

WASHERS AND RINGS

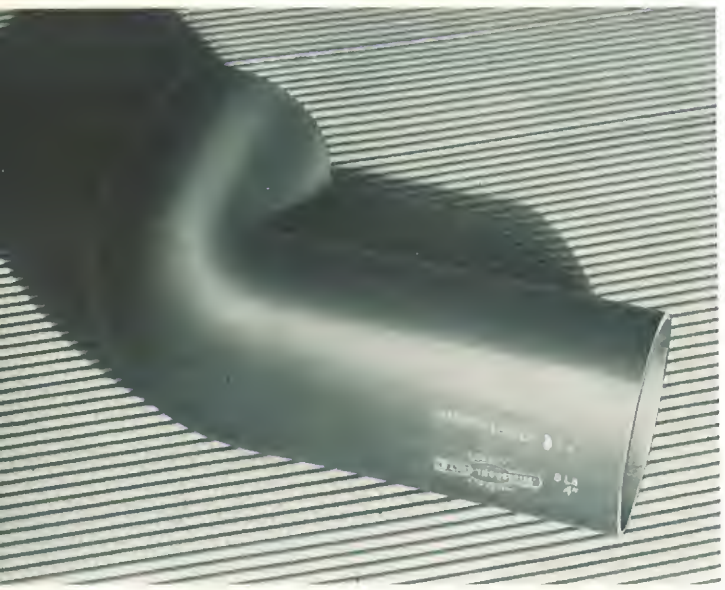
Fibre Washer, Large	Each,	$0.05
Fibre Washer, Small	Each,	.02
Rubber Washer, Large	Each,	.03
Rubber Washer, Small	Each,	.01
Rings, Without Caps	Each,	.30

No reduction will be made for vented caps without tail pieces. For caps with extra long threads, a charge of 50 cents each and upwards will be added to list.

WEIGHT OF LEAD USED FOR DRUM TRAPS

4-inch Standard equals Lead Pipe weighing 5 lbs. per ft.
4-inch Special equals Lead Pipe weighing 6 lbs. per ft.
4-inch Extra Heavy equals Lead Pipe weighing 8 lbs. per ft.
5-inch Standard equals Lead Pipe weighing 8¼ lbs. per ft
5-inch Extra Heavy equals Lead Pipe weighing 10 lbs. per ft.
6-inch Standard equals Lead Pipe weighing 10 lbs. per ft.
6-inch Extra Heavy equals Lead Pipe weighing 13 lbs. per ft.

LEAD BENDS



We manufacture a complete assortment of lead bends to meet every modern building requirement. All bends are extruded under high pressure from refined lead only. They are uniform in wall thickness and true to size.

In ordering, specify weight division, inside diameter, type of inlet and length of outlet.

DIMENSION SCALE FOR LEAD BENDS

Dimensions are taken as shown by arrows	SHORT BEND 	LONG BEND 
SIZE	CENTER TO ENDS	CENTER TO ENDS
1¼-inch	6 inches 3½	6 inches
1½ "	7 " 4	7 "
2 "	7¾ " 3¾	7¾ "
3 "	8¼ " 4¼	8¼ "
4 "	10 " 5½	10 "

COMBINATION (Lead and Iron) BENDS and FERRULES

Our combination bends and ferrules are carefully manufactured to insure ease of installation and a tight connection. They are fitted with a cast iron drive ferrule of the highest quality.

COMBINATION (Lead and Iron) FERRULES

Our combination ferrules come up to the same high standard as our bends and ferrules. Made only from first-grade metals, they can be depended upon to give long satisfactory service.

SHORT AND LONG BENDS • EXTENSION BENDS

U. S. STANDARD PRICE LIST

	Standard (Lightest) Weight					Special (Medium) Weight			Extra Heavy Weight				
Weight Per Running Foot In Pounds..	1½	2¼	3¼	5	6	2	3	4	2½	3½	4½	6	8
Diameter In Inches	1¼	1½	2	3	4	1¼	1½	2	1¼	1½	2	3	4
Short Bend	$0.25	$0.38	$0.57	$1.09	$1.50	$0.31	$0.51	$0.69	$0.34	$0.62	$0.80	$1.21	$1.84
Long Bend	.30	.50	.78	1.39	1.95	.41	.66	1.00	.50	.79	1.05	1.60	2.40
*Short Inlet—12″ Outlet	.40	.56	.79	1.39	1.70	.52	.75	.99	.60	.90	1.08	1.57	2.09
*Short Inlet—15″ Outlet	.47	.67	.94	1.65	2.00	.62	.89	1.17	.72	1.07	1.28	1.87	2.45
*Short Inlet—18″ Outlet	.55	.77	1.09	1.90	2.30	.72	1.03	1.36	.84	1.24	1.49	2.16	2.81
*Short Inlet—20″ Outlet	.60	.84	1.19	2.07	2.48	.79	1.12	1.49	.92	1.35	1.63	2.35	3.04
*Long Inlet—12″ Outlet	.46	.67	.99	1.73	2.15	.60	.89	1.24	.70	1.07	1.35	1.96	2.62
*Long Inlet—15″ Outlet	.54	.77	1.14	1.99	2.44	.70	1.03	1.42	.82	1.24	1.56	2.25	2.98
*Long Inlet—18″ Outlet	.62	.88	1.29	2.24	2.73	.80	1.17	1.61	.94	1.41	1.76	2.54	3.34
*Long Inlet—20″ Outlet	.67	.95	1.39	2.42	2.92	.87	1.26	1.74	1.02	1.52	1.90	2.74	3.58
For each inch of length over listed size, add	.03¼	.04½	.06¼	.10¾	.12	.04¼	.06	.07¾	.05	.07	.08½	.12	.15

*Short inlets are same dimensions as inlets on short bends of corresponding size; long inlets are same as on long bends.

STOCK PACKAGES

A Barrel of Short Bends Contains	150	75	60	30	15	150	75	60	150	75	60	30	15
A Barrel of Long Bends Contains	100	50	36	24	12	100	50	36	100	50	36	24	12

COMBINATION (LEAD AND IRON) BENDS AND FERRULES

U. S. STANDARD PRICE LIST

Length of Outlet	12″	13″	14″	15″	16″	17″	18″	19″	20″
Standard Weight									
4″ Short Inlet*	$2.20	$2.30	$2.40	$2.50	$2.60	$2.70	$2.80	$2.90	$3.00
4″ Long Inlet**	2.65	2.75	2.85	2.94	3.04	3.14	3.23	3.33	3.42
Extra Heavy Weight									
4″ Short Inlet*	2.59	2.71	2.83	2.95	3.07	3.19	3.31	3.43	3.54
4″ Long Inlet**	3.12	3.24	3.36	3.48	3.60	3.72	3.84	3.96	4.08

*Short inlets are 5½″ long; the pipe used weighs 6 lbs. per running foot.
**Long inlets are 9¾″ long; the pipe used weighs 8 lbs. per running foot.

COMBINATION (LEAD AND IRON) FERRULES

U. S. STANDARD PRICE LIST

	Lengths (In Inches)													
Standard Weight	4	4½	5	6	8	10	12	14	16	18	20	24	30	36
1¼″ for 2″ Cast Iron Pipe		$0.28	$0.36	$0.43	$0.51	$0.60	$0.67	$0.80	$0.90	$1.00	$1.10	$1.30	$1.40	$1.65
1½″ for 2″ Cast Iron Pipe		.28	.36	.43	.51	.60	.67	.80	.90	1.00	1.10	1.30		
2″ for 2″ Cast Iron Pipe	$0.28		.41	.46	.57	.67	.76	.80	.86	.92	1.00	1.15	1.40	1.65
3″ for 3″ Cast Iron Pipe	.42		.60	.67	.82	.98	1.10	1.15	1.22	1.30	1.40	1.60	2.00	2.30
4″ for 4″ Cast Iron Pipe	.50		.72	.85	1.02	1.25	1.40	1.60	1.73	1.85	2.10	2.30	2.75	3.25
Extra Heavy Weight														
1½″ for 2″ Cast Iron Pipe		.38	.44	.52	.61	.72	.80	1.15	1.30	1.45	1.60	1.90		
2″ for 2″ Cast Iron Pipe	.42		.49	.54	.67	.81	.93	1.10	1.23	1.36	1.49	1.75	2.20	2.60
3″ for 3″ Cast Iron Pipe	.55		.75	.84	1.00	1.18	1.35	1.46	1.63	1.80	1.97	2.33	2.90	3.40
4″ for 4″ Cast Iron Pipe	.70		.84	.94	1.23	1.45	1.67	2.00	2.21	2.45	2.70	3.16	3.76	4.36

STOCK PACKAGES

A Full Barrel of 1¼″ or 1½″ x 2″ Contains		160	160	160	120	80	80	See Note A		32	32	See Note A	
A Full Barrel of 2″ Contains	200		160	160	120	80	80	See Note A		32	32	See Note A	
A Full Barrel of 3″ Contains	100		80	80	60	40	40	See Note A		15	15	See Note A	
A Full Barrel of 4″ Contains	72		50	50	38	25	25	See Note A		10	10	See Note A	

Note A: Ferrules 14″, 16″, 18″, 30″ or 36″ in length are packed in boxes containing 12 or 24 pieces to the box.
Note B: Any barrel of 4″ ferrules may be packed to carry an equal number of 3″, 2″ or 1½″ nested within the 4″.

ACCESSORIES

U. S. STANDARD PRICE LIST

Diameter	1¼″	1½″	2″	3″	4″	5″	6″
Iron Thimbles for Ferrules—each			$0.15	$0.20	$0.25		$0.75
Brass Thimbles for Ferrules—each			.38	.70	1.00		
Brass Spuds for Soldering Nipples—each	$0.20	$0.25	.45	.75	1.00		

COMBINATION (Lead and Brass) SOLDERING NIPPLES

All brass parts on our combination bends and soldering nipples are accurately made from the finest quality metal. The lead portion is extruded and the two joined together in a neat, workmanlike manner.

COMBINATION (LEAD AND BRASS) SOLDERING NIPPLES

U. S. STANDARD PRICE LIST

Length—In Inches	4	5	6	8	10	12	14	16	18	20	24	30	36
Standard Weight													
1¼″ for 1¼″ Iron Pipe	$0.39	$0.42	$0.44	$0.52	$0.58	$0.63	$0.73	$0.78	$0.83	$0.90	$1.00	$1.20	$1.30
1½″ for 1½″ Iron Pipe	.48	.55	.60	.66	.74	.80	.93	1.00	1.07	1.15	1.30	1.48	1.65
2″ for 2″ Iron Pipe	.72	.81	.86	.96	1.08	1.17	1.37	1.47	1.56	1.68	1.87	2.27	2.58
3″ for 3″ Iron Pipe	1.26	1.43	1.50	1.67	1.86	2.00	2.27	2.41	2.56	2.70	3.00	3.53	4.00
4″ for 4″ Iron Pipe	1.63	1.84	1.95	2.13	2.36	2.53	2.93	3.10	3.27	3.45	3.80	4.35	4.92
Extra Heavy Weight													
1¼″ for 1¼″ Iron Pipe	.41	.45	.48	.56	.64	.71	.79	.86	.93	1.00	1.15	1.37	1.60
1½″ for 1½″ Iron Pipe	.51	.56	.60	.71	.82	.92	1.04	1.14	1.24	1.34	1.55	1.85	2.15
2″ for 2″ Iron Pipe	.79	.85	.90	1.04	1.18	1.31	1.47	1.60	1.72	1.85	2.12	2.52	2.92
4″ for 4″ Iron Pipe	1.70	1.95	2.15	2.35	2.55	2.75	3.15	3.35	3.55	3.75	4.25	4.75	5.70

COMBINATION (LEAD AND BRASS) BENDS AND SOLDERING NIPPLES

U. S. STANDARD PRICE LIST

Length of Outlet	12″ or Less	13″	14″	15″	16″	17″	18″	19″	20″
Standard Weight									
1¼″—Short Inlet	$0.79	$0.82	$0.86	$0.86	$0.89	$0.93	$0.94	$0.97	$0.99
—Long Inlet	.85	.88	.92	.93	.96	1.00	1.01	1.04	1.06
1½″—Short Inlet	1.04	1.09	1.13	1.15	1.20	1.24	1.25	1.30	1.32
—Long Inlet	1.15	1.20	1.24	1.25	1.30	1.34	1.36	1.41	1.43
2″ —Short Inlet	1.51	1.57	1.64	1.66	1.72	1.79	1.81	1.87	1.91
—Long Inlet	1.71	1.77	1.84	1.86	1.92	1.99	2.01	2.07	2.11
3″ —Short Inlet	2.65	2.76	2.87	2.91	3.02	3.13	3.16	3.27	3.33
—Long Inlet	2.99	3.10	3.21	3.25	3.36	3.47	3.50	3.61	3.68
4″ —Short Inlet	3.33	3.45	3.57	3.63	3.75	3.87	3.93	4.05	4.11
—Long Inlet	3.78	3.90	4.02	4.07	4.19	4.31	4.36	4.48	4.55
Extra Heavy Weight									
1¼″—Short Inlet	.99	1.04	1.09	1.11	1.16	1.21	1.23	1.28	1.31
—Long Inlet	1.09	1.14	1.19	1.21	1.26	1.31	1.33	1.38	1.41
1½″—Short Inlet	1.38	1.45	1.52	1.55	1.62	1.69	1.72	1.79	1.83
—Long Inlet	1.55	1.62	1.69	1.72	1.79	1.86	1.89	1.96	2.00
2″ —Short Inlet	1.80	1.89	1.97	2.00	2.09	2.17	2.21	2.30	2.35
—Long Inlet	2.07	2.16	2.24	2.28	2.37	2.45	2.48	2.56	2.62
3″ —Short Inlet	2.83	2.95	3.07	3.13	3.25	3.37	3.42	3.54	3.61
—Long Inlet	3.22	3.34	3.46	3.51	3.63	3.75	3.80	3.92	4.00
4″ —Short Inlet	3.72	3.87	4.02	4.08	4.23	4.38	4.44	4.59	4.67
—Long Inlet	4.25	4.40	4.55	4.61	4.76	4.91	4.97	5.12	5.21

STOCK PACKAGES OF SOLDERING NIPPLES

Length—In Inches	4	6	8	10	12	20	24
A Full Barrel of 1¼″ Contains	200	200	150	100	100	40	40
A Full Barrel of 1½″ Contains	160	160	120	80	80	30	30
A Full Barrel of 2″ Contains	120	120	90	60	60	20	20
A Full Barrel of 3″ Contains	75	60	45	30	30	15	15
A Full Barrel of 4″ Contains	60	48	36	24	24	10	10

Note: Soldering nipples 14″, 16″, 18″, 30″ or 36″ in length are packed in boxes with 12 or 24 to the box.

SHEET LEAD

Sheet lead is produced by rolling or milling Its manufacture involves first the casting of large slabs, several inches thick, from pigs of pure lead or a desired lead alloy. These slabs are then rolled, either hot or cold depending upon the composition of the lead, between steel rollers to a specified thickness.

For many years, we have been the nation's leading supplier of high quality sheet lead. Our product is made only from standard accepted brands of prime lead and lead alloys. It is guaranteed to be exactly as specified with respect to thickness or weight and to be free from irregularities, laminations and other defects.

SIZES AND WEIGHTS

The standard size for milled sheet lead, weighing three pounds per square foot or over, is 8'6" wide by 20' long. The standard size for sheet lead weighing less than three pounds per square foot is 4' to 5' wide by 15' long. However, we are able to furnish sheets on short notice which are considerably larger in width and length than these standard sizes. The maximum sizes are given in the table on the following page.

Sheet lead may be specified either by its weight per square foot or its thickness. There is a rough mathematical correlation between the two. Pure lead sheet weighing one pound per square foot is $\frac{1}{64}$" thick. Except in the larger sizes, each additional pound per square foot adds $\frac{1}{64}$" to the thickness.

Commonly used weights of sheet lead are shown in the table on the next page. Other weights per square foot can be rolled on short notice.

DIRECTIONS FOR ORDERING

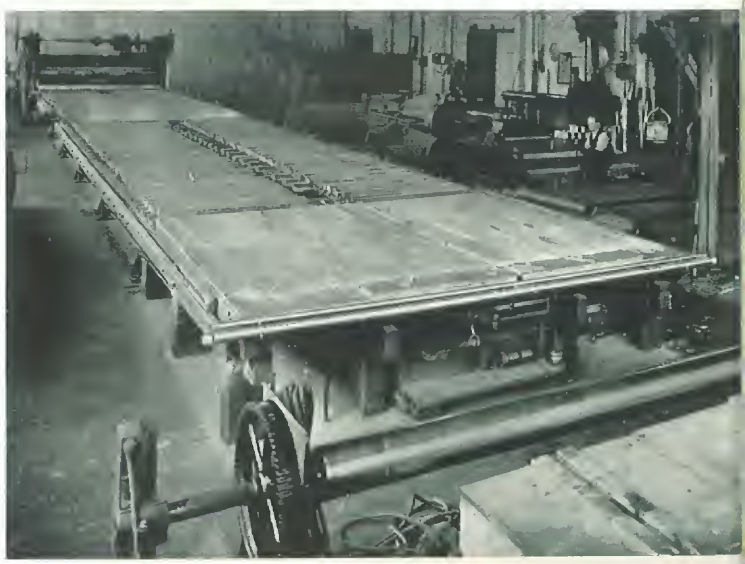
In ordering sheet lead, specify the type of lead wanted, the weight per square foot or the thickness and the number and size of the sheets. In ordering sheet lead in other than regular stock sizes, please follow the instructions below:

Our care in manufacture insures sheet lead of accurate thickness and weight.

If plain rectangular sheets are wanted, state clearly the width and length. In the case of irregular shape sheets, forward a sketch giving dimensions or send a drawing of the object to be lined or covered, stating clearly all dimensions.

PACKING

Unless otherwise specified, all sheet lead is shipped in rolls which are carefully packed in wooden slats and fastened with steel straps, wire or rope.



View of a sheet lead rolling mill showing rollers which propel the lead, and cutting table in foreground.

SHEET LEAD SIZES AND WEIGHTS

The weights given below apply to common lead only. Other types of lead, such as antimonial or hard lead, weigh slightly less for a given thickness.

Pounds Per Sq. Ft.	Actual Thickness	App. Thickness in Inches		Maximum Sizes
		Decimal	Fraction	
¾		.0117	1/80	4′x15′
1		.0156	1/64	8′x20′
1½		.0234	3/128	8′x20′
2		.0312	1/32	7′x45′
2½		.0391	5/128	9′x45′
3		.0468	3/64	10′x45′
3½		.0547	7/128	10′x45′
4		.0625	1/16	10′x45′
5		.0781	5/64	10′x43′
6		.0937	3/32	10′x43′, 11′x40′ 11′6″x30′, 11′9″x20′
8		.1250	1/8	10′x40′ 11′6″x35′
10		.1563	5/32	11′x40′ 10′x48′
12		.1875	3/16	11′6″x40′ 11′x40′ 11′6″x35′
14		.2188	7/32	11′6″x40′ 11′9″x30′
16		.2500	1/4	11′6″x40′ 11′9″x30′
20		.3333	1/3	11′6″x40′ 11′9″x38′
24		.4000	2/5	11′9″x30′ 11′x34′ 11′6″x32′
30		.5000	1/2	11′x27′ 11′6″x25′6″ 12′x16′
40		.6667	2/3	11′x24′ 12′x16′
60		1.0000	1″	12′x12′

SHEET LEAD

in building construction

Above: *Construction detail of the lead-covered dome of the New Jersey State Reformatory at Rahway, N. J. All seams shown, including those where the sheets join the batten caps, are loose-locked to provide for expansion and contraction.*

Right: *General view of the Reformatory and its lead-covered dome. Nearly 75,000 pounds of sheet lead were required for this job.*

Below: *This photograph shows a lead-covered cornice and through-wall flashing. The cornice covering has been attached to the flashing with a loose-locked seam.*

SHEET LEAD FOR ROOFING

One of the most important and, incidentally, one of the oldest uses of sheet lead is for roofing and related building purposes such as flashings, cornice coverings, gutter linings and the like.

Its chief advantage for this purpose is permanence. Lead is non-rusting and more resistant to atmospheric corrosion than any other non-ferrous metal. Consequently, properly installed, sheet lead roofing and flashings rarely require repair or replacement.

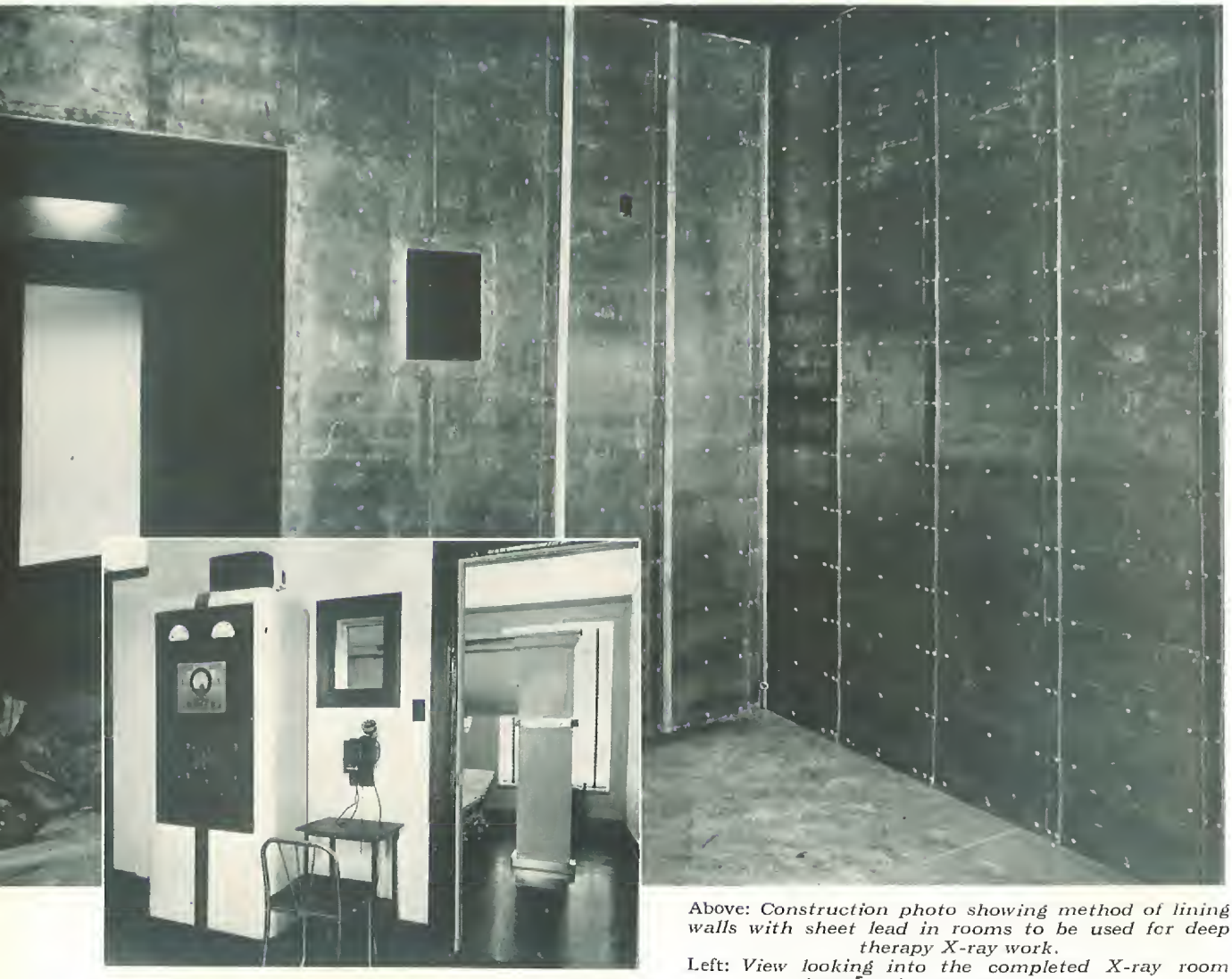
Another advantage lies in appearance. After exposure to the weather, lead takes on a soft, gray patina which goes well with any architectural style. Moreover, lead roofs and flashings do not stain other building materials.

The type of sheet lead most frequently specified for roofing and flashing is hard lead—an alloy of common lead and antimony. The distinct advantage gained by using hard lead lies in the fact that its weight is less than that of soft or common lead for a given thickness. Six per cent antimonial lead is approximately five per cent lighter than

common sheet lead.

The proper weight of sheet lead to use for roofing depends upon the nature of the installation. For gutter linings, cornice coverings, base flashings and roofing purposes generally, three pound sheet is recommended. For cap flashings and batten roofs where the battens are fairly close together, two and one-half pound sheet will suffice.

SHEET LEAD FOR X-RAY EQUIPMENT



Above: *Construction photo showing method of lining walls with sheet lead in rooms to be used for deep therapy X-ray work.*
Left: *View looking into the completed X-ray room shown under construction above.*

A unique characteristic of lead is its ability to absorb short wave length radiations, such as X-rays and radium emanations. Because of this special quality, sheet lead is used extensively for wall and cabinet linings, protective shields and other purposes in hospitals and laboratories where these powerful radiations are handled.

The proper thickness of lead to use varies, of course, with the quantity of radium present or the voltages generated in the X-ray equipment. In a handbook dealing with X-ray protection issued by the U. S. Department of Commerce, sheet lead approximately 1/25″ thick is recommended where peak voltages do not exceed 75 kv. As the voltage increases, the thickness increases in greater proportion, approaching 1½″ where 600 kv. are generated.

SHEET LEAD FOR SOUND-DEADENING AND VIBRATION ABSORPTION

Left: *These doors to an N. B. C. broadcasting studio, made from layers of wood and sheet lead, are said to reduce noise by an average of 39.56 decibels.*

Above: *Lead "anti-vibration pad" under a grillage in a New York hotel.*

Lead does not ring when struck and is not easily set in vibration. This fact, combined with its mass, accounts for its successful use in deadening sound and vibration.

For vibration absorption, particularly under a building foundation, the sheet lead is usually formed into an "anti-vibration pad". These pads in most cases consist of two layers of eight pound sheet lead enclosing layers of asbestos board, the whole being about an inch thick. Where loads are lighter, smaller pads are used. In some installations merely the sheet lead itself is sufficient.

For sound absorption, construction methods vary. In one installation—a broadcasting studio—the doors are laminated with three layers of wood and two layers of four pound sheet lead. In another, four pound sheet lead lines the walls, floor and ceiling of a laboratory interior.

SHEET LEAD FOR SHOWER BATH PANS

This sheet lead shower pan is designed for a three-shower installation. It will provide positive and permanent waterproofing.

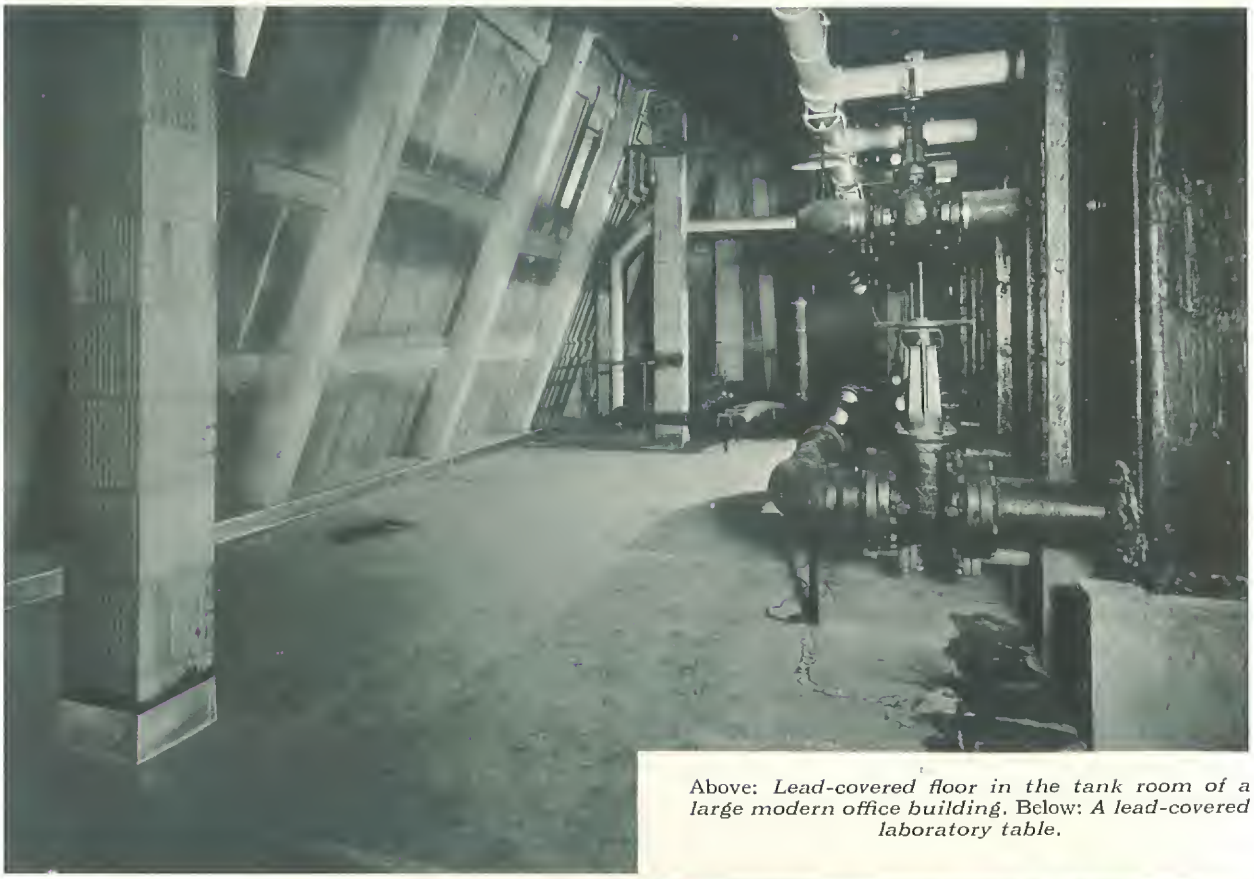
In the Rome of antiquity, baths were lined with sheet lead to keep them water-tight. For the same reason, many modern shower stalls have a lead pan at the base to keep water from seeping through the floor.

Lead shower pans are easy to install and per-

manent. The sheet lead dresses down evenly over the surface to be covered, leaving no voids to permit later settlement and possible damage to the finished tile floor. It is not damaged by building movement and permanently protects against the seepage of moisture.

For shower stall installation, six pound sheet lead is the usual specification. When placed in contact with concrete or mortar, the lead is painted with asphaltum or coated with tar to protect it during the initial period against attack by the fresh lime contained in those materials.

SHEET LEAD FOR FLOORS AND TABLE TOPS



Above: *Lead-covered floor in the tank room of a large modern office building.* Below: *A lead-covered laboratory table.*

An interesting, although a rather specialized use of sheet lead is as a covering for floors and table tops in laboratories, hospitals and industrial plants.

Lead flooring has been found to give better and longer service where corrosive substances are handled. It has also been used successfully in plants handling inflammables or explosives where it tends to prevent sparking. Lead table tops for industrial laboratories, besides being non-corrosive, are said to reduce the breakage of glassware.

SHEET LEAD

for handling corrosive chemicals

Because of its high corrosion resistance, sheet lead is virtually a standard material for the lining of vats, tanks, agitators and similar types of equipment in chemical and industrial plants. It is also employed extensively as a protective covering for apparatus subjected to corrosive fumes or acid splash.

Sheet lead has been used successfully with a wide variety of acids and chemicals. Of special note is its fine service record in the concentration and handling of sulphuric, phosphoric and hydrofluoric acids, for handling sulphite solutions in the paper industry and for sulphonation and chlorination processes in the organic chemicals industry.

Above: *Lead covered drum-type acid filter in a pigment manufacturing plant. The trough in the foreground is also formed from sheet lead. The revolving drum is made of perforated lead.*

Left: *Sheet lead lining being installed in a circular concrete settling tank. Note the vertical steel straps which support the lining. These straps are later covered with strips of lead. One strap has already been covered.*

Below: *Dehydrator stack connections in an acid plant. These flues, formed from sheet lead, carry steam containing sulphuric acid.*

In addition to corrosion resistance, sheet lead has other desirable properties which adapt it to industrial use. Being pliable and malleable, it is easily worked and can be readily shaped to conform to the interiors or exteriors of chemical apparatus. The low melting point of lead facilitates the "burning" of sheets to form continuous corrosion resistant surfaces. Finally, sheet lead's rela-

tively low initial cost and high salvage value make it more economical than many other materials that are sometimes used.

GRADES OF SHEET LEAD

For construction purposes in chemical and industrial plants, we manufacture sheet lead of several different types. The standard grades furnished are chemical lead, tellurium lead, tellurium-antimonial lead, antimonial lead, and crawlproof lead, a reinforced chemical lead. Descriptions of these grades are given on the pages that follow.

Occasionally, sheet lead of a special composition is required for certain types of equipment. We are in a position to furnish these special leads, according to specification, on short notice.

SELECTION OF SHEET LEAD

The various grades of sheet lead differ more or less widely in mechanical strength and corrosion resistance under a given set of conditions. If there is no previous service record to guide the selection of sheet lead for a particular installation, the industrial engineer should first determine, by means of actual plant tests or by consultation with the technical staff of National Lead Company, the grade which will best serve his purpose.

CHEMICAL LEAD SHEET

Chemical lead sheet is rolled from "chemical lead," a term used in the trade to designate a type of lead produced from southeast Missouri ores.

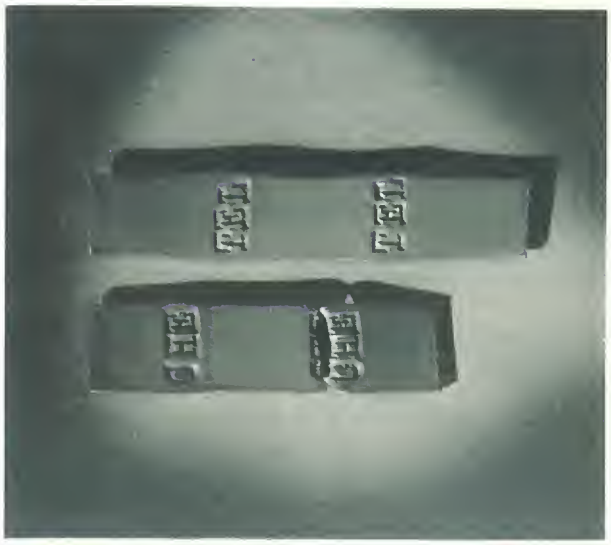
Chemical lead is a practically pure lead, free from bismuth and characterized by the presence of about .06% copper. The copper is advantageous in several respects: it increases the normal corrosion resistance of lead; raises its recrystallization temperature, thus retarding grain growth; and gives lead a greater tensile strength and higher endurance limit or fatigue strength.

Chemical lead has been used successfully in the chemical industry for more than a generation. It may properly be called the base lead for acid-handling purposes since virtually all other grades intended for industrial use are simply chemical lead, alloyed with varying quantities of other metals.

Our chemical lead sheet is rolled only from standard accepted brands of prime lead which conform to Grade II of the A.S.T.M. standard specifications (B29-35). It is furnished in any gauge from 1/64" up.

Large lead-lined mixing tank. Inlet and outlet connections are also of lead.

Strips of lead with and without tellurium content after immersion in 96% sulphuric acid at 305°C. for 3 minutes. Tellurium lead weight loss, 0.97%—other lead 5.11%.



Strips of lead, with and without tellurium content, stamped and then stretched. Stamping strengthened tellurium lead (top): weakened the other lead.

TELLURIUM LEAD SHEET*

Tellurium lead sheet is rolled from a grade of lead obtained by adding a small quantity of tellurium (less than 0.1%) to primary chemical lead.

One outstanding feature resulting from the addition of tellurium is improved corrosion resistance—particularly under conditions where corrosion is most severe—at high temperatures, when vibration or mechanical strain is also present. In a flash test, specimens of tellurium lead and lead without tellurium were held at 305°C. in 96% sulphuric acid for three minutes. The lead containing tellurium showed a weight loss of only 0.97%; the other lead showed a weight loss of 5.11%.

Another quality which tellurium develops in lead is the capacity to work-harden—to strengthen under strain. Tellurium lead, toughened by mechanical action such as rolling, bending, stretching or hammering, actually has a greater tensile strength and resistance to fracture than before.

Tellurium lead's ability to strengthen itself has been of great practical value in plants where the nature of the operation or the design of the equipment puts an undue burden on the corrosion

*Pat. No. 2,060,534

SERVICE REPORTS ON TELLURIUM LEAD

An Explosives Manufacturer

"Its rate of corrosion is about half that of ordinary lead."

A Chemical Company

"We estimate approximately 25 per cent longer life from tellurium lead as compared to other leads."

A Soap Manufacturer

"After 8 months' service, the tellurium lead lining in our tub shows no signs of creeping and very little if any corrosion, although subjected to 10 per cent boiling sulphuric acid."

A Rayon Manufacturer

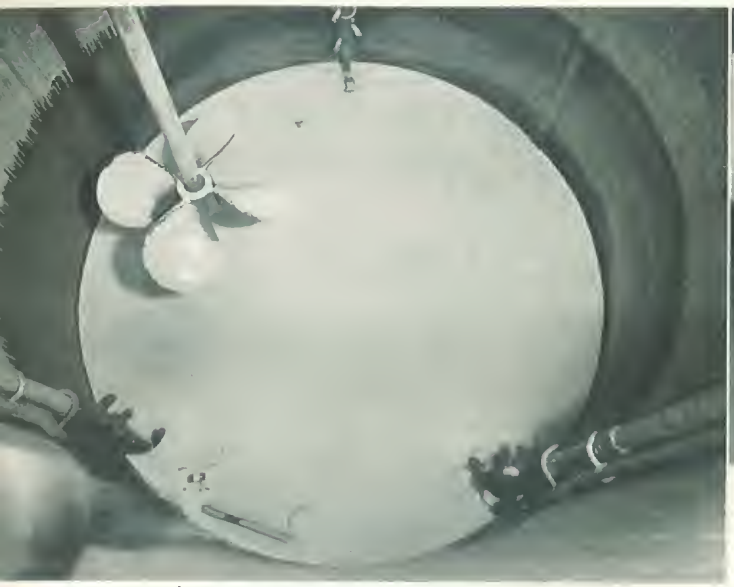
"Our tellurium lead lining—in service two years—still conforms to the tank shape as snugly as on installation. No bulging has occurred."

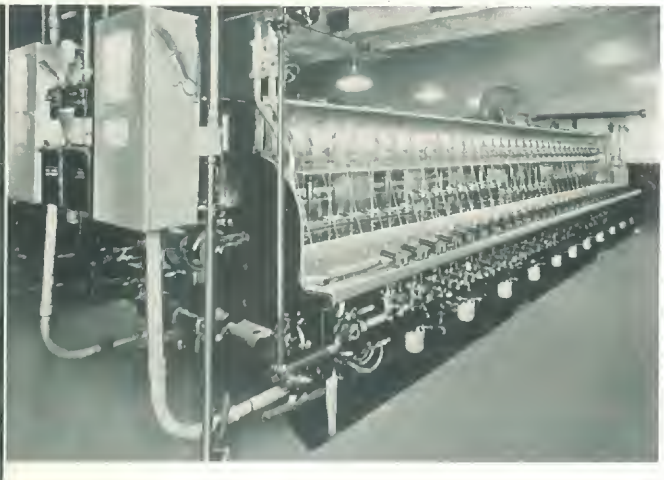
A Battery Manufacturer

"The 3-year old tellurium lead lining in our large sulphuric acid mixing tank is very smooth and uniform with no sign whatever of buckling, although the tank is used for cutting raw acid. Other linings have given us trouble by buckling and cracking."

A Metal Refinery

"For the last two years, we have purchased all our lead requirements in tellurium lead. We find a considerable advantage in its stiffness and resistance to vibration crystallization."





Tellurium lead's longer life under vibratory stress makes it a suitable material for the linings of mixing tanks (left), for the coverings on rayon spinning machines (above), or for other equipment subject to vibration.

resistant materials used. For example, tellurium lead tends to give longer service when employed as a lining in tanks where frequent and rapid heat changes occur. Movements of the lining due to expansion or contraction toughen the lead at the point of deformation. Subsequent movements due to expansion take place at other points over the lining, lessening the possibility of fatigue fracture.

Still another quality of tellurium lead—due in part to its capacity to work-harden—is a higher endurance limit and therefore a greatly improved resistance to failure under vibratory stresses. Where vibration exists, tellurium lead appears to set up an opposition to the vibration, toughening and strengthening itself to the point where it withstands considerable buckling or creeping.

Tellurium lead in sheet form is available in any gauge from $\frac{1}{64}$" up.

TELLURIUM-ANTIMONIAL LEAD SHEET

Tellurium-antimonial lead sheet is made from tellurium lead, alloyed according to specification with various percentages of antimony. As in the case of straight antimonial lead sheet described in some detail on the opposite page, the antimony content usually specified is 6%.

In general, the addition of antimony to tellurium lead produces the same physical changes as those noted for straight antimonial lead. Harder and stiffer than straight tellurium lead, its better resistance to abrasion makes it suitable for linings subject to considerable erosion.

Tellurium-antimonial lead sheet is furnished in any gauge from $\frac{1}{64}$" up.

Installing a tellurium-antimonial lead lining in an oil refinery agitator. In this particular installation, the depth of the tank and the relatively few supporting straps indicated the use of a sheet lead hardened and stiffened with antimony.

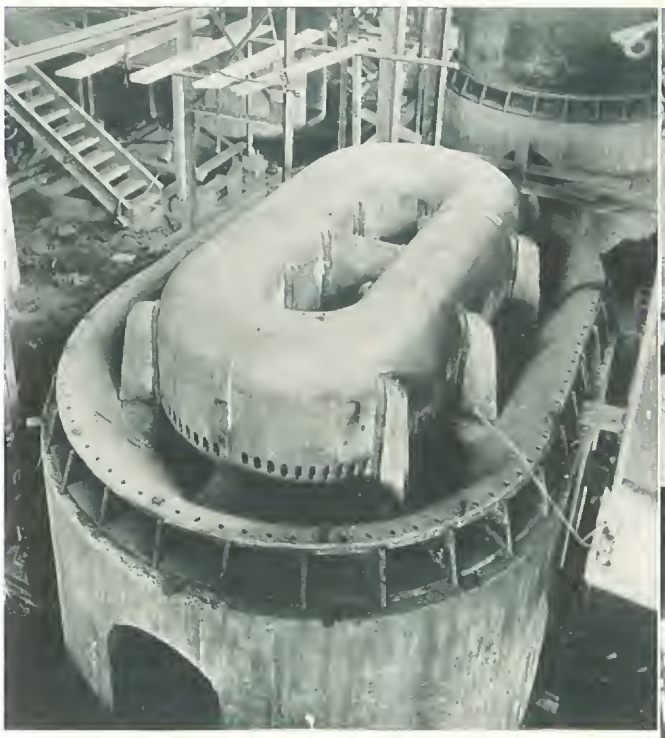
ANTIMONIAL LEAD SHEET

Antimonial or "hard" lead in sheet form is made from chemical lead, alloyed according to specification, with various percentages of antimony in order to obtain greater mechanical strength. The antimony contents usually specified range from 4% to 10%, 6% being specified in most cases.

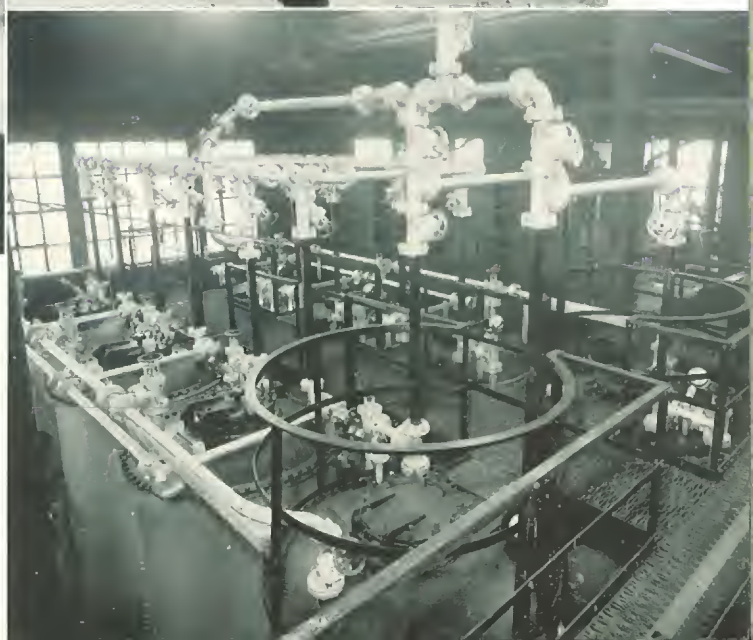
The tensile strength of 6% antimonial lead is approximately twice that of chemical lead. This fact, combined with its greater hardness and stiffness, makes it a suitable material for use in tanks where the mechanical strain is severe or where linings are supported by a skeleton framework. Also antimonial lead has better abrasion resistance than chemical lead and is therefore better suited to installations where erosion is a problem. Finally, antimonial lead is more resistant to cutting or mechanical injury when hit or struck by harder metals and tends to give better service as a lining in tanks where this condition exists.

Due to the fact that antimony lowers the melting point of lead from 620°F to 477°F, antimonial lead is more affected than is chemical lead by elevated temperatures. As the heat rises, it loses its mechanical strength more rapidly as well as its ability to resist acid attack. Antimonial lead is not recommended for use with temperatures above 220°F–240°F.

Antimonial lead sheet is furnished in any gauge from 1/64" up. The specific gravity of antimonial lead is lower than that of chemical lead; consequently sheets of the same size and thickness are lighter. Antimonial lead sheet, containing from 4% to 6% of antimony, weighs approximately 3.2% less than chemical lead sheet.



Above: *Partly assembled evaporator in a by-product coke plant. Interior of the evaporator is lined with sheet lead. The "cracker pipe" at center and the large diameter connecting pipes shown in photo at upper right, are formed from heavy gauge antimonial lead sheet.*



Right: *A battery of selenium precipitate tanks in a copper refining plant. The tanks are lined with 6 per cent antimonial lead sheet.*

CRAWLPROOF SHEET LEAD

In tanks, vats or agitators where linings are subjected to a relatively severe strain, crawlproof sheet lead provides a greater measure of freedom from buckling, crawling and similar movements than does chemical lead sheet.

Crawlproof lead is chemical sheet lead reinforced in the center with antimonial lead bars. The bars are placed exactly like steel rods in reinforced concrete and firmly embedded so that no separation can take place.

Crawlproof sheet lead is furnished in any gauge from 1/32" up and in any size not exceeding 7½' in width by 35' in length. Each sheet is marked showing the direction of the reinforcing bars.

BURNING BAR OR ROD LEAD

An important feature of lead construction in chemical equipment is the welding or "burning" operation. Lead sheets are joined together by fusing them at a well-cleaned joint by means of a torch and a strip of lead known as a "burning bar". The latter is usually of the same composition as the sheets to be joined.

We manufacture burning bar in any desired composition and any desired shape. Usually burning bar is furnished in circular wire form, 3/8" in diameter, and is shipped on reels.

ANTIMONIAL LEAD ANODES

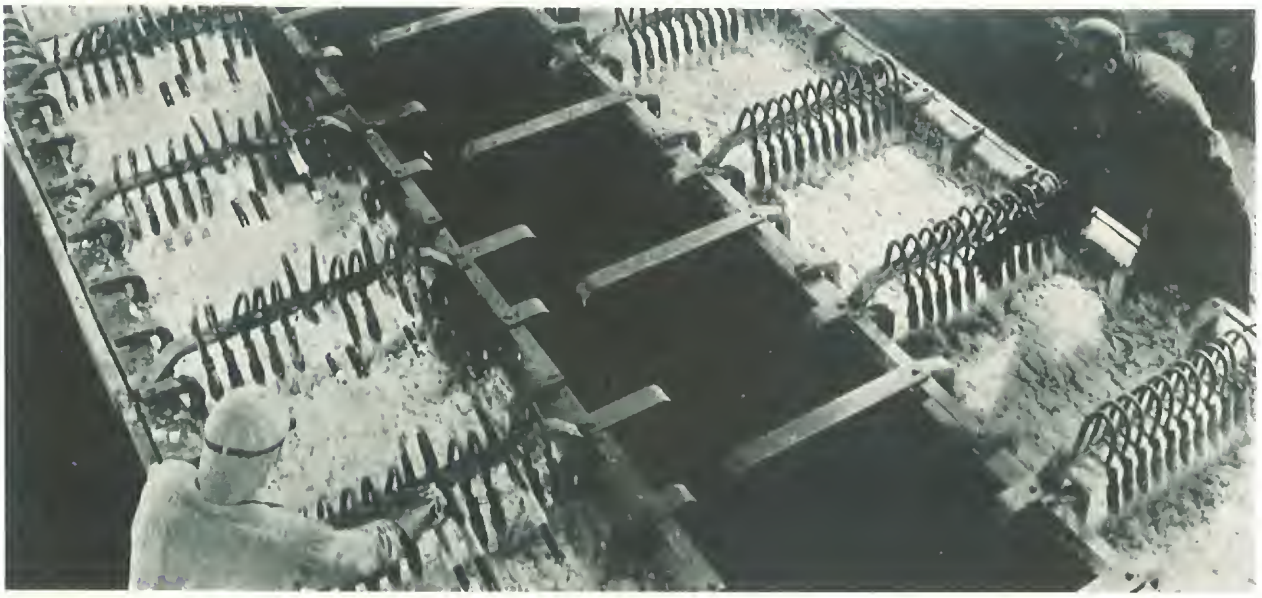
Lead anodes containing 6% antimony are used successfully in chromium-plating equipment. Experience has shown that they provide a uniform distribution of electrical current in the chromic acid bath and wear down evenly on both sides.

We manufacture antimonial lead anodes (or lead anodes of any other desired composition) in any size according to the customer's specification. The usual anode is in strip form, 1/8" to 1/4" thick, 4" to 8" wide and 20" to 36" long.

Our anodes are made only from pure metals, doubly refined. They are highly polished and free from all blemishes. They are packed flat, well protected for shipping.

In tanks where antimonial lead anodes are used, the tank lining should always be antimonia sheet lead, never chemical sheet lead.

Lead alloy anodes being used in a special process for zinc-coating steel wire. The coating is applied as the wire feeds through the lead-lined plating tanks.



LEAD-LINED EQUIPMENT

For some purposes in the chemical and acid industries, particularly where high pressures and temperatures, agitation or vacuum are involved, ordinary lead equipment lacks the mechanical strength necessary for long service. For use under severe operating conditions of this nature, we manufacture a complete line of lead-lined and hard (i.e. antimonial) lead equipment.

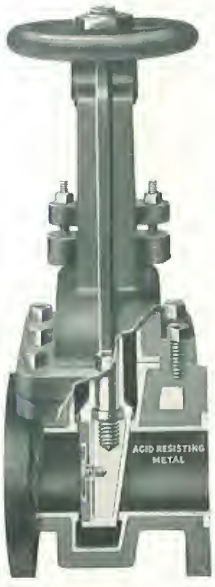
LEAD-LINED PIPE AND FITTINGS

Lead-lined pipe is made either of steel or iron, lined with a seamless chemical lead tube, which has been extruded like ordinary lead pipe, and then inserted and bonded to the outer casing. This method insures a smooth interior in which friction is reduced to a minimum.

Our "United Tubond" chemical lead-lined pipe is a high quality product, guaranteed to have an absolutely uniform lining, free from porous or defective spots. It is furnished in the same lengths as standard steel pipe, varying from 16 to 22 feet depending upon the diameter.

We also manufacture flanged lead-lined pipe and flanged fittings. These products are made up with a bonded chemical lead lining carried over the face of the recessed flange. This insures a positive lead-to-lead joint at each flange, eliminating any danger of leakage.

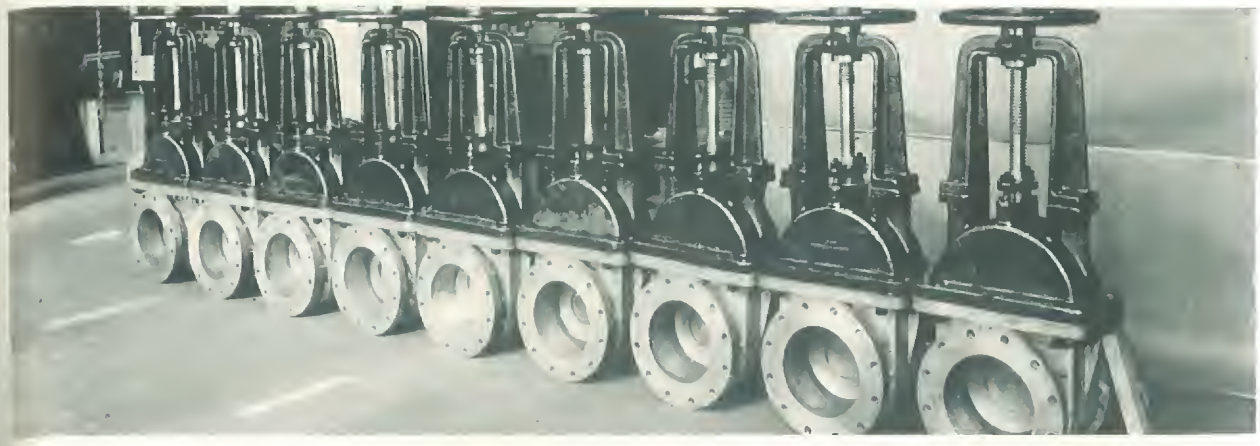
LEAD-LINED AND HARD LEAD VALVES



Left: *"United" hard lead Chem-Rayon "Y" plug and seat flanged valve.* Right: *"United" chemical hard lead-lined wedge type flanged acid gate valve (with section cut away to show inner construction).*

We manufacture acid valves of various types in both lead-lined and hard lead patterns.

Our "United" lead-lined acid valves are lined on all portions of the interior with hard lead and, being constructed of iron,



A group of 10-inch hard lead wedge type gate valves for use in a rayon plant.

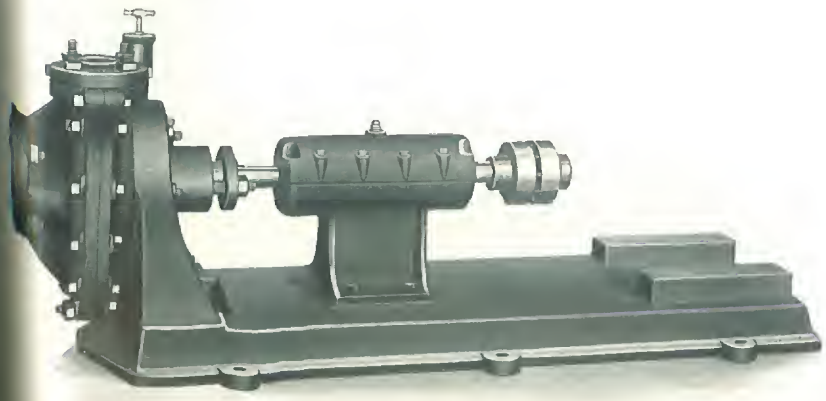
offer the strength of the cast iron valve with full acid resisting qualities. These valves are furnished in all required sizes and styles: gate, angle, check, diaphragm and free flow "Y" type; also special valves according to specification.

"United" hard lead acid valves are furnished in the same patterns as lined valves. Each one has a body of hard lead with reinforcing fins cast integral, affording maximum strength while reducing the weight to a minimum.

HARD LEAD ACID RESISTANT PUMPS

Where gravity flow is not available to convey solutions to succeeding stages of operation, acid resisting pumps must be used. We manufacture hard lead centrifugal pumps of two types, the open or "horizontal" pattern and the vertical shaft pump. An unusual feature of the vertical pump is the elimination of the packing gland. The boot serves as both suction chamber and auxiliary supply tank. "United" horizontal pumps are self lubricating with large internal grease glands supplied by compression cups. The casing is of hard lead with the impeller of the same alloy cast around a reinforcing spider.

Below: *"United" horizontal hard lead centrifugal acid pump.* Right: *"United" vertical hard lead centrifugal acid pump (packingless type).*



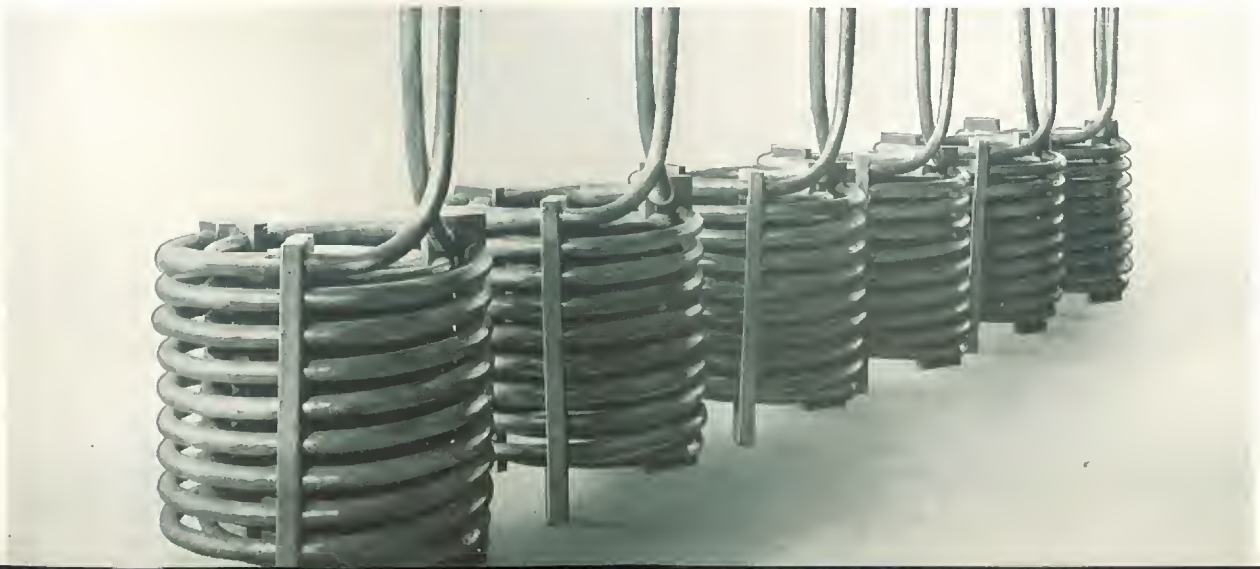
A battery of ten homogeneous lead-lined vertical steel blow cases ready for shipment to a chemical plant.

HOMOGENEOUS LEAD EQUIPMENT

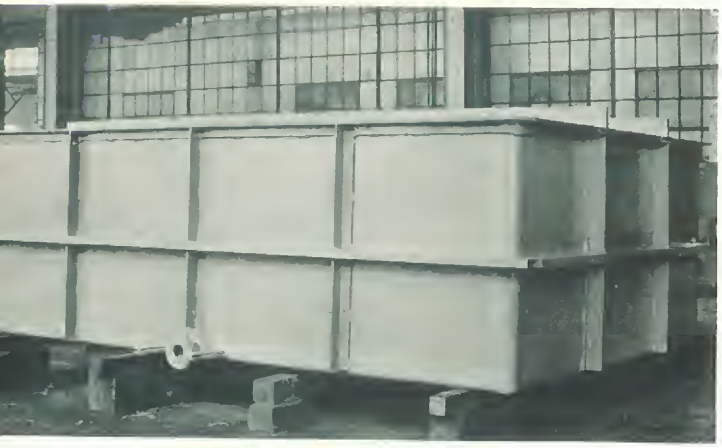
Homogeneous lead-lined or lead-covered apparatus, including such equipment as storage tanks, autoclaves, heating coils and jacketed pressure tanks of all descriptions, is designed for use under operating conditions where high steam pressure and vacuum are encountered, or where heat transfer is of importance. Equipment of this type manufactured by us is being successfully used by many industrial plants throughout the country and time and again has demonstrated its superiority over the older types of loose lined equipment.

The outstanding feature of homogeneous lined or covered equipment is the firm adherence of the lead. By our method of manufacture, the lead lining or covering is inseparably bonded to the steel, copper or brass of which a particular piece of

Six homogeneous lead-covered copper coils for use in a pigment manufacturing plant.



Above: *Three homogeneous lead-lined steam separators.* Below: *A homogeneous lead-lined tank. Homogeneous lead-covered coils were installed in the tank.*



apparatus is constructed. The bonding of the lead approaches 100%. It will not separate or come off unless heat is applied close to the melting point of lead (620°F.) and is capable of withstanding shock, vibration, vacuum and rapid changes in temperature.

Besides its application for the lining of tanks, kettles, stills, drums and the like, the homogeneous process is used successfully for the covering of agitators, propellers, and mixing devices of all descriptions.

SERVICE

Lined equipment for chemical and allied plants usually varies according to the type of operation for which it is intended. In the case of homogeneous equipment, for example, it is necessary to fabricate the apparatus to meet individual requirements. Our engineering department offers its service to anyone having acid contact problems to solve. If blue prints and sketches are submitted, we will be pleased to offer suggestions in detail as to the most economical and satisfactory use of our products. Address inquiries to National Lead Company, Lined Products Department, 111 Broadway, New York City.

TYPICAL INSTALLATIONS OF HOMOGENEOUS EQUIPMENT

EQUIPMENT	PRODUCT	CONTACT	TEMP.	STEAM PRESSURE	VACUUM
Tanks and Lead-Covered Coils	Alum	66° Be. to Dilute Sulphuric Acid	220° F.	—	—
Extractors, Scrubbers, Separators	Sulphur Dioxide	—	200° F.	60 lbs.	—
Autoclave	Chemicals	25% Sulphuric	482° F	575 lbs.	—
Tank	Chemicals	14% Sulphuric	212° F.	110 lbs.	29½"
Tank Coils	Chemicals	Ferrous Sulphate, 25% Sulphuric	230° F.	40 lbs.	—
Tanks and Covers	Acid Recovery	Sulphuric Acid Mist	180° F.	—	29"
Tanks	Naphthalene	40% Sulphuric	200° F.	40 lbs.	—
Car Tanks	Battery Acid	66° Be. Sulphuric Acid	Atmosp.	—	—

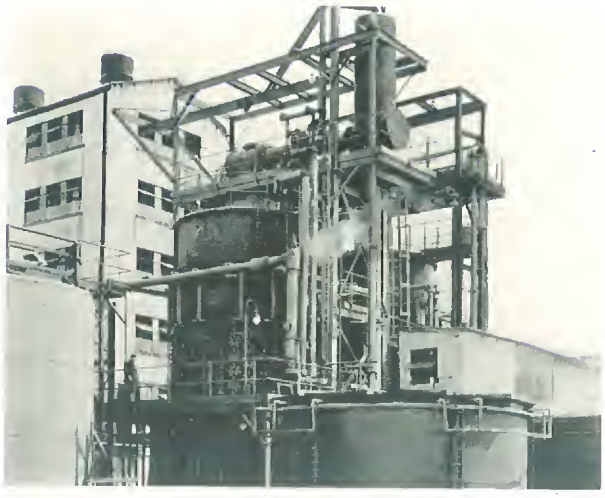
ACID RECOVERY EQUIPMENT

The oil industry, chemical concerns and some rayon plants use large quantities of sulphuric acid, the disposal and recovery of which often proved in the past a difficult and expensive problem due to acid losses, obnoxious fumes, etc.

The development of the Simonson-Mantius Vacuum Process, in which acids are recovered in a closed vessel under vacuum, has served to overcome many if not all of the difficulties involved in acid recovery by older methods.

For the application of this process, the Acid Recovery Department of National Lead Company builds and sells: concentrators for spent sulphuric acid, chamber acid and sludge acid; stills for the purification of impure acid; evaporators for weak solutions of sulphuric and phosphoric acid; coolers and crystallizers for acid solutions and separating plants for sludge acid.

A Type E Super Vacuum Concentrator for the recovery of waste acid containing metallic sulphates.



Two Type E Super Vacuum Concentrators producing 66° Be. acid from de-nitrated acid.

PROCESS

In the Simonson-Mantius Vacuum Process, patented in the United States and foreign countries, the acid is concentrated with steam at from 5 lbs. to 150 lbs. pressure under a vacuum of from 27″ to 29.8″ so that the boiling temperature of the finished acid will rarely exceed 300° F. The high vacuum practically eliminates all foaming. The proper vapor speed and low boiling point reduce losses due to entrainment and distillation to less than one-half of one per cent. No fumes are given off by our concentrators.

Well separated sludge acid is usually concentrated to 60°, 65° or 66° Be. Spent acid and chamber acid are usually concentrated to 93.2% H_2SO_4 but can also be brought up to 95% and 97% H_2SO_4 at reasonable cost.

In all cases where the strength of the acid does not exceed 61° Be., the concentrators are equipped with multi-jet condensers of the barometric type, but for higher strength acid it is necessary to add a vacuum booster which will create in the concentrator a vacuum up to 29.8″. To avoid contamination of the cooling water, surface condensers, instead of the barometric condenser, have also been used.

CONSTRUCTION

All concentrators are of substantially the same design. The outside shell is made of cast iron for small sizes and steel plate for larger units. The inside is lined with sheets of chemical lead $\frac{5}{16}$" to $\frac{1}{2}$" thick. All vertical and horizontal joints are burned from the outside facilitating inspection and repairs. The lead lining is protected by a heavy layer of acid proof bricks laid in suitable cement. Openings are protected by high silicon iron sleeves. The heating surface consists of antimonial lead or chemical lead tubing for steam pressures up to 45 lbs., and of lead-covered copper tubes or high silicon iron tubes for a pressure up to 150 lbs. Condensers and vacuum boosters are made of hard lead, special bronze or high silicon iron. Where necessary, concentrators are equipped with electric level indicators.

All concentrators, crystallizers and evaporators are specially designed for the capacity and operating conditions for which they are to be used. No attempt is made to adapt one standard apparatus to all possible working conditions.

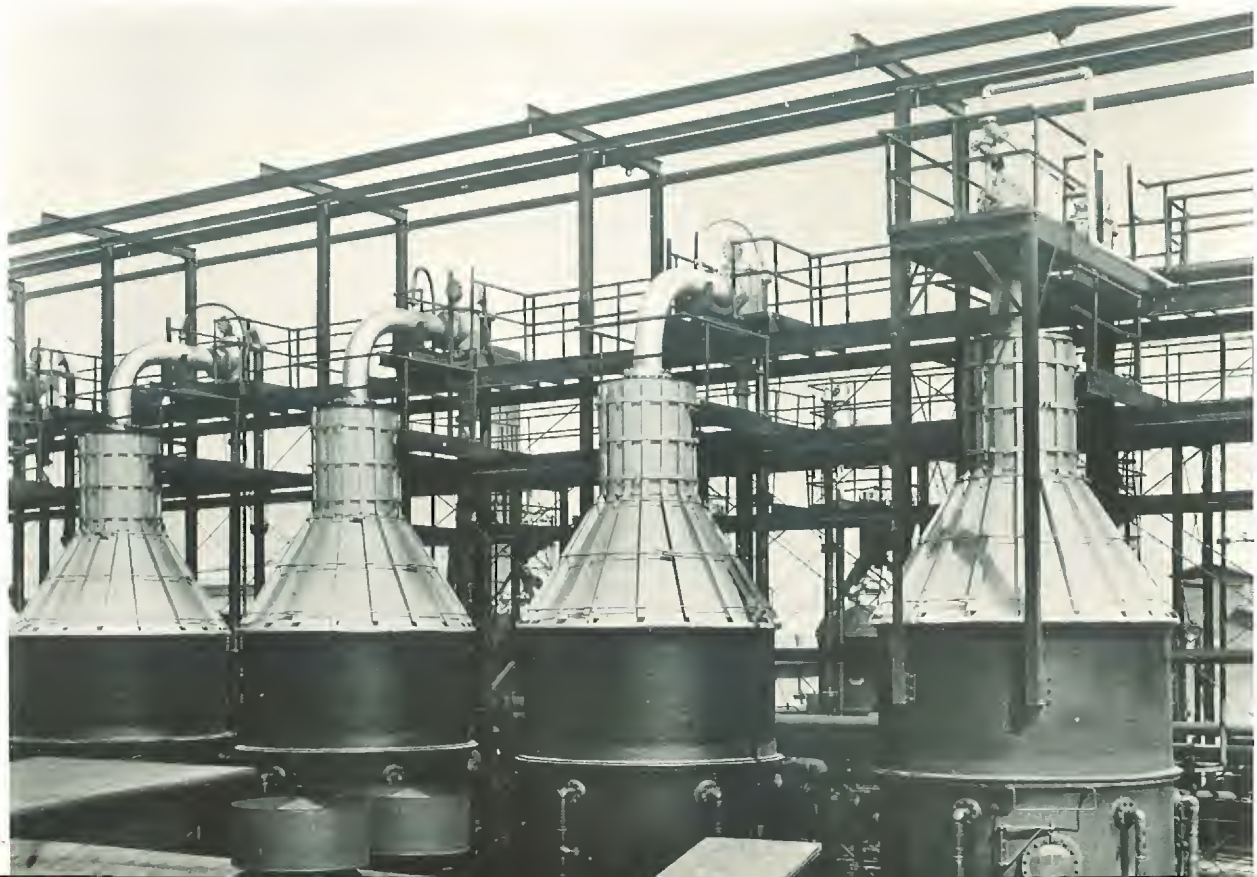
APPLICATION OF PROCESS

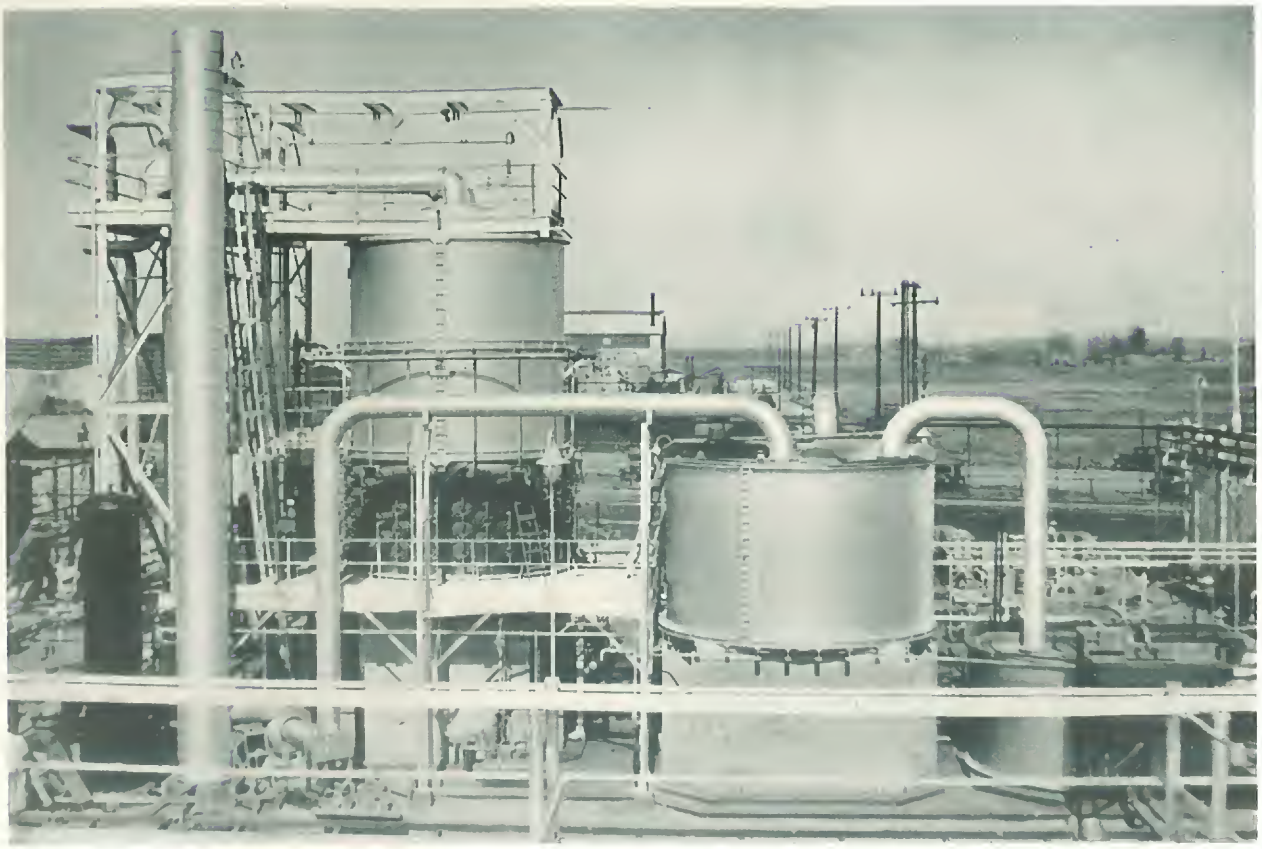
Spent Acid. Large quantities of sulphuric acid are used in the chemical industry for the concentration of nitric acid and the absorption and drying of alcohols. Such dilute acids are concentrated to 93% and 96% in our Super Vacuum Concentrators at low cost and high efficiency. There are no difficulties due to organic or inorganic impurities. Capacities vary from 10 tons to 100 tons of H_2SO_4 handled in one unit.

Some of the waste acids contain large quantities of sulphates which must be separated before the acid is fit for re-use. Sulphates of copper and nickel can be handled in our special Salting-Out Concentrators without difficulty and are separated from the finished acid by centrifugals or vacuum filters.

Ferrous sulphate must be separated from the acid under strict control of concentration and temperature as otherwise the sulphate will be precipitated in the form of a slime which cannot be separated from the acid efficiently. After five years of extensive research work and experimentation a

A battery of four Type B concentrators producing 60° and 66° Be. acid from separated sludge acid in the oil refining industry.





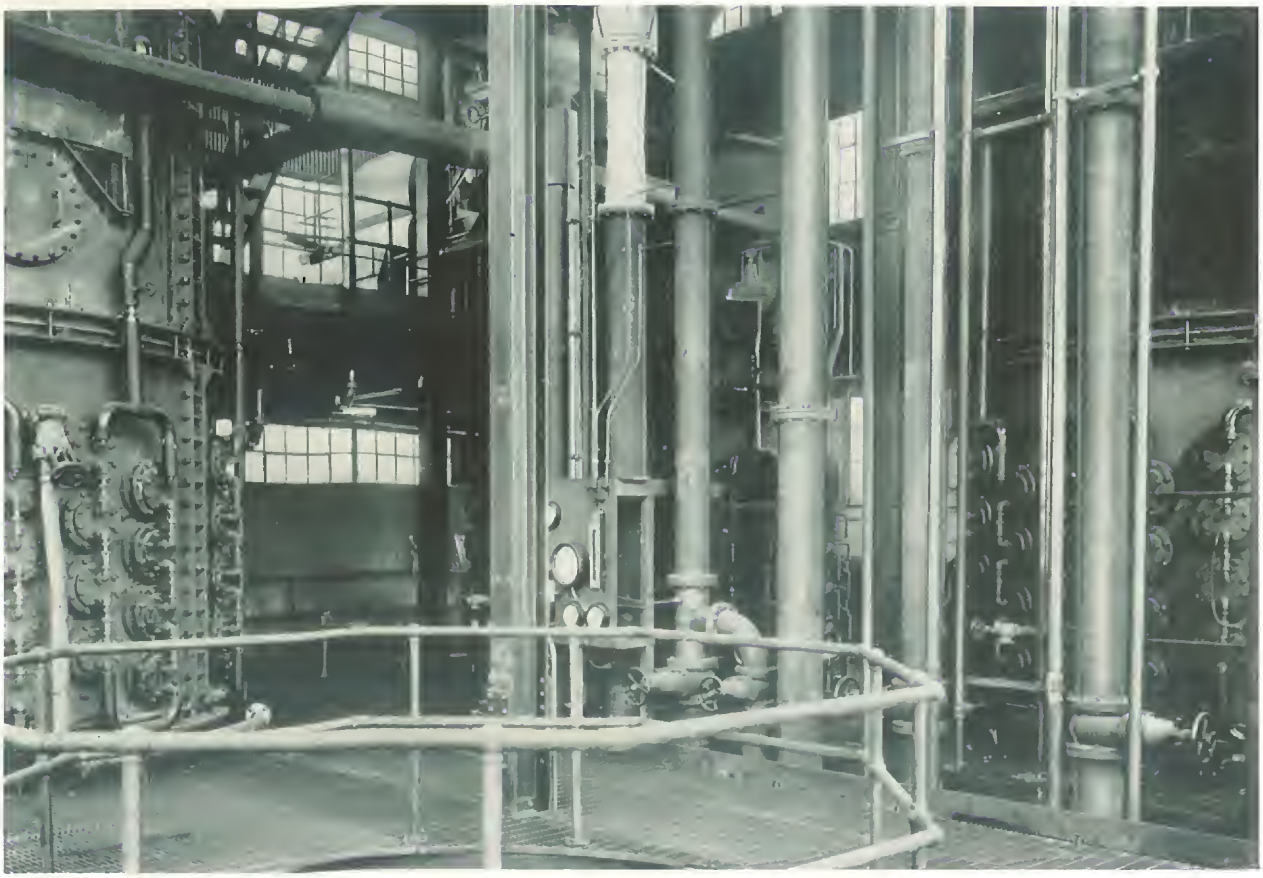
A concentrating plant including a Type E Super Vacuum Concentrator and feed tank for the concentration of spent acid to 66° Be.

process has been developed, patents granted and pending, whereby such waste acids are concentrated under vacuum to an acidity of about 56% so that the ferrous sulphate is separated in a granular form. The 56% acid, which now contains only about 1% of sulphates, is further concentrated to 80% or 93% and the precipitated sulphate is removed by settling or by centrifuging in a continuous solid bowl centrifugal. This sulphate residue is mixed with the granular sulphate precipitate of the 56% acid, and after being washed, the ferrous sulphate can be used for the production of sulphuric acid in a chamber or contact plant.

Waste pickling acid can be recovered by concentration in single or double effect to about 30% acidity and the ferrous sulphate is recovered in the form of copperas or monohydrate. All the acid in the waste liquor is again returned to the pickling tanks which makes it possible to maintain a uniform acidity in the pickling vats and reduce the time of pickling. This process can be used economically even in smaller mills and will show a good profit if a market can be found for the copperas.

Rayon and Cellophane Bath Acid. Our Type "A" Rapid Circulation Evaporators are handling more than 5000 tons of bath acid per day. The construction is such that very little incrustation occurs on the heating surface which can, if necessary, be readily cleaned without entering the evaporator. Entrainment losses are less than one-half of one per cent.

Sludge acid is concentrated in some refineries from about 30° Be. to 60° Be. and then reinforced with fuming acid or sulphur trioxide to the proper strength for treating oil; in other refineries the 60° acid is further concentrated to 65° or 66° Be. In our Super Vacuum Type Concentrator a well-separated acid can be concentrated to 66° Be. without intermediate settling, and losses due to foaming are negligible.



Three Type E Concentrators handling waste sulphuric acid containing ferrous sulphate. Used in a plant manufacturing paint pigments.

SEPARATING PLANTS FOR SLUDGE ACID

National Lead Company has designed and installed complete plants for the separation of sludge acid; where necessary, these plants are equipped with absorption towers to eliminate the fume nuisance.

ACID STILLS

Sometimes the concentrated spent acid contains inorganic salts in solution, and where a technically pure acid is required for the process the impure acid can be distilled under vacuum at reasonable cost. The distillate will of course be absolutely free from these salts and the remaining sludge can be recovered so that there is no loss of acid.

VACUUM COOLERS AND CRYSTALLIZERS

The company has furnished vacuum coolers of large capacity for impure acids to avoid troublesome incrustation of the cooling surface. It is also prepared to furnish complete Vacuum Crystallizing Plants for the removal of copperas, glaubersalt and other salts from waste acids.

INSTALLATIONS

More than 110 Concentrators have been installed, many of them repeat orders, in the United States and foreign countries. Several of these units have been in continuous operation for 15 years.

INQUIRIES

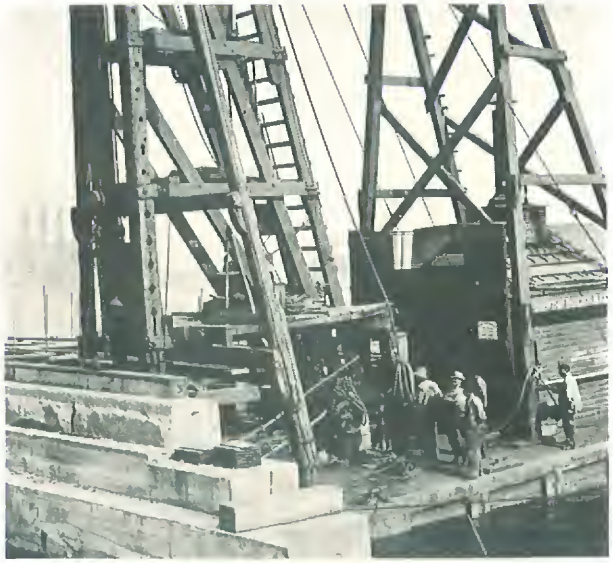
National Lead Company has the exclusive rights to build and sell concentrating plants and give licenses for the Simonson-Mantius Vacuum Process. Inquiries should be directed to National Lead Company, Acid Recovery Department, 111 Broadway, New York.

CINCH ANCHORING SPECIALTIES

Cinch anchoring specialties, which include the ring wedge Cinch anchor, Cinch drive sleeve expansion bolt and the Cinch cylinder, provide an economical and a sure way of securing fixtures of all types to masonry. They are being used successfully to anchor machinery, overhead shafting and sprinkler systems, guard rails, theatre marquises, signs, ornamental fixtures and the like.

Essentially, Cinch anchorages are expansion units consisting of an iron cone, a ring, and a lead composition member. One or more of the units are fitted over a bolt and caulked into place with a length of pipe or special caulking tool designed for the purpose. The caulking expands the lead member into all crevices and irregularities of the hole which has been drilled to receive it.

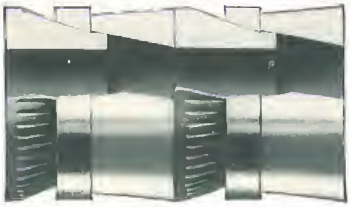
Properly installed, Cinch anchorages cannot pull out or work loose. Vibration does not loosen their grip. They provide an anchorage which is guaranteed to hold beyond the tensile and shearing strength of any wrought iron or steel bolt. In addition, Cinch anchoring specialties are easy to set in place and require a hole of less depth than other expansion devices.



View of test made with one-inch three-unit plain Cinch anchors which held a yellow pine backing log, 12" x 12" x 22' 10", to a granite coping mounted on a concrete water-front retaining wall. Despite a vertical pull estimated at 90,000 lbs., the anchors were undisturbed after the test.

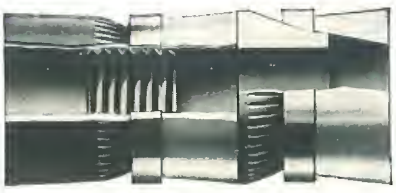
RING WEDGE CINCH ANCHOR

TYPE I



Above: *Two plain ring wedge Cinch anchor units with section cut away to show the three parts of each unit.*

Below: *Two ring wedge Cinch anchor units, the one on the left threaded.*



TYPE II

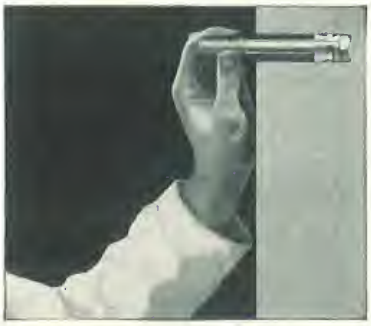
Each unit of the ring wedge Cinch anchor consists of three parts: a conical wedge of malleable iron, a lead composition part and an expanding hard metal ring. Under tension, the ring dams the lead preventing any possibility of the lead crawling, and also insures a tight hold in an oversize hole.

For anchorages of ordinary strength, two units are used. Three or more units provide anchorages of correspondingly greater strength. In installations where the head of the bolt is out of the hole, the unit first inserted has a malleable iron cone which is threaded. Where the head of the bolt is in the hole, the malleable iron cone is not threaded.

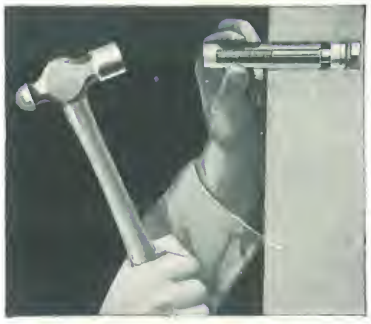
Ring wedge Cinch anchors are furnished in two or three-unit sets, plain or threaded.

METHOD OF INSTALLING PLAIN RING WEDGE CINCH ANCHORS—TYPE I

(Used when the head of the bolt is in the hole.)

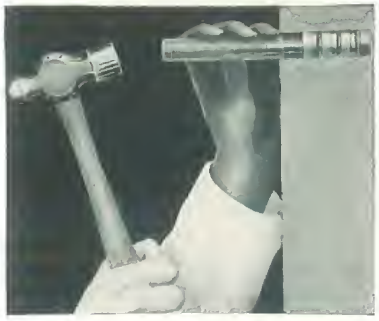


1. *Place the first unit of the ring wedge Cinch anchor on the bolt and insert the head of the latter in the hole.*



2. *Expand the anchor unit by swedging with a piece of pipe or with the special caulking tool illustrated on the second page following.*

3. *Where a two-unit anchorage is being used, add another plain unit and expand with pipe or tool as before.*

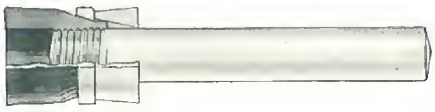


4. *If more than a two-unit anchorage is required, add the additional units expanding each one in turn.*

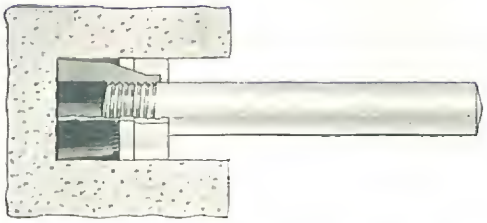
Note—For Cinch anchors up to and including one-half inch in size, use square-head bolts. For sizes above one-half inch, use hexagon-head bolts as holes for these sizes will not take a square-head bolt.

METHOD OF INSTALLING THREADED RING WEDGE CINCH ANCHORS—TYPE II

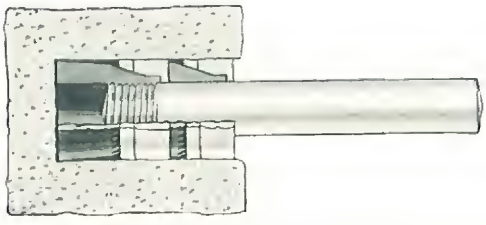
(Used when the head of the bolt is out of the hole.)



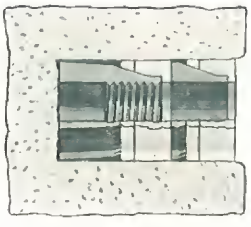
1. *Assemble the first unit of the threaded ring wedge Cinch anchor on a dummy bolt as shown above.*



2. *Insert the unit with the dummy bolt in the hole and expand by caulking with a piece of pipe or special tool.*



3. *Slip the second unit of the Cinch anchor over the bolt into the hole. Expand this unit the same way as the first.*



4. *Remove the dummy bolt. The work may now be attached to the anchorage by re-engaging the threaded cone at the bottom.*

NET PRICE PER HUNDRED SETS OF RING WEDGE CINCH ANCHORS

Two Unit Sets (without bolts)
One unit threaded and one unit plain; or both units plain.

Diameter of Bolt Sizes	Price per 100 sets of 2 complete units	Minimum Depth of Holes for two-units	Diameter of Hole and Drill Required
3/16	$7.00	7/8	1/2
1/4	8.00	1 1/16	5/8
5/16	9.00	1 1/16	5/8
3/8	11.00	1 1/2	13/16
1/2	18.00	1 3/4	1
5/8	24.00	1 7/8	1 1/8
3/4	35.00	2 1/2	1 3/8
7/8	44.00	2 3/4	1 1/2
1	63.00	3 1/4	1 5/8
1 1/8	140.00	4 1/2	2
1 1/4	150.00	4 3/4	2 1/8
1 1/2	220.00	5 1/4	2 3/8
1 3/4	320.00	8	3 1/2

NOTE: If no 13/16" drill is available, a 3/4" drill can be used.

Three Unit Sets (without bolts)
One unit threaded and two units plain; or three units plain.

Diameter of Bolt Sizes	Price per 100 sets of 3 complete units	Minimum Depth of Holes for three-units	Diameter of Hole and Drill Required
3/16	$10.50	1 1/8	1/2
1/4	12.00	1 5/8	5/8
5/16	13.50	1 5/8	5/8
3/8	16.50	2 1/4	13/16
1/2	27.00	2 5/8	1
5/8	36.00	2 7/8	1 1/8
3/4	52.50	3 3/4	1 3/8
7/8	66.00	4	1 1/2
1	94.50	4 7/8	1 5/8
1 1/8	210.00	6	2
1 1/4	225.00	6 1/4	2 1/8
1 1/2	330.00	7 1/4	2 3/8
1 3/4	480.00	12	3 1/2

NOTE: If no 13/16" drill is available, a 3/4" drill can be used.

CINCH DRIVE SLEEVE EXPANSION BOLT

(TYPE 27)

(TYPE 28)

The Cinch drive sleeve expansion bolt (Type 27) consists of an extended, threaded cone, an expanding lead unit and a hard metal drive sleeve. The latter takes the place of a caulking tool when the bolt is installed in holes varying from 9/16" to 1 3/8" in depth.

The Cinch drive sleeve expansion bolt (Type 28) consists only of the threaded extension cone with the expanding lead unit. The latter is expanded with a caulking tool in the regular manner.

NET PRICE PER HUNDRED OF TYPE 28

Size Bolt	Price per 100	Depth of hole required	Diameter of hole and drill required
8 x 32	$5.00	9/16"	5/16"
10 x 24	5.50	3/4"	3/8"
12 x 24	7.25	1"	1/2"
1/4 x 20	8.00	1 3/8"	5/8"

NET PRICE PER HUNDRED OF TYPE 27

Size Bolt	Price per 100	Depth of hole	Diameter of hole and drill required
6 x 32	$3.80	3/8"	1/4"
8 x 32	4.50	1/2"	5/16"
10 x 24	4.95	5/8"	3/8"
12 x 24	6.50	7/8"	1/2"
1/4 x 20	7.20	7/8"	1/2"
5/16 x 18	9.75	1"	5/8"
3/8 x 16	12.00	1"	3/4"
3/8 x 16 Ex. long	12.00	1 1/2"	3/4"
7/16 x 14	15.00	1"	3/4"
7/16 x 14 Ex. long	15.00	1 1/2"	3/4"
1/2 x 13	15.00	1"	7/8"
1/2 x 13 Ex. long	15.00	1 1/2"	7/8"
5/8 x 11	25.00	1 3/4"	1 1/8"
3/4 x 10	38.00	2"	1 3/8"

CINCH CYLINDER

The Cinch cylinder is a two-unit anchor in one piece. Either end of the cylinder can be slipped over the bolt, quickly caulked into place and the work attached. The regular Cinch collar is present at the base of each cone to prevent the alloy from crawling when the bolt sustains its load.

Net Price Per Hundred Cinch Cylinders (Without Bolts)

Diameter of Bolt	Price Per 100	Type Bolt Head	Size Hole Drill	Minimum Depth Hole
1/4"	$7.50	Sq.	1/2"	1"
3/8"	10.50	Sq.	13/16"	1 3/8"
1/2"	17.50	Sq.	1"	2"
5/8"	22.50	Hex.	1 1/8"	2 1/4"
3/4"	33.50	Hex.	1 1/4"	2 1/2"
1"	59.00	Hex.	1 5/8"	3"

CINCH BRAND FOUR-POINT DRILL

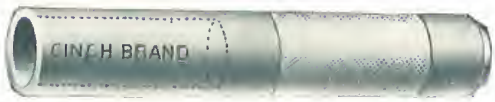
The Cinch brand four-point drill is made from high carbon steel in ten sizes ranging from 1/2" to 1 5/8" in diameter. The standard length of all drills is 12".

Net Price of Drills Per Dozen

Diameter of Bolts	Diameter of Drills	Price per dozen 12 inches long
3/16	1/2	$11.00
1/4	5/8	12.00
5/16	5/8	12.00
3/8	13/16	16.00
7/16	13/16	16.00
1/2	1	18.00
5/8	1 1/8	24.00
3/4	1 3/8	35.00
7/8	1 1/2	50.00
1	1 5/8	75.00

Note—The Standard length of these drills is 12 inches. Price of longer drills on application. Write for discounts.

CINCH BRAND CAULKING TOOL



The Cinch brand caulking tool is used for expanding all types of Cinch units. It is made in ten sizes to fit bolts ranging in diameter from 3/16" to 1".

Net Price of Individual Tools

Diameter of Bolt	Net price Each	Diameter of Bolt	Net price Each
3/16	$.40	1/2	$ .85
1/4	.50	5/8	1.50
5/16	.50	3/4	1.80
3/8	.60	7/8	2.10
7/16	.60	1	3.40

LEAD SCREW ANCHOR FOR WOOD SCREWS

This is the standard lead composition screw anchor for use with wood screws. The screw cuts its own thread.

Net Price Per Hundred Screw Anchors

No.	Screw	Length of Shield	Out-side Diam.	Price per 100
1/8 x 3/4"	Nos. 5-6-7	3/4"	1/4"	$4.40
3/16 x 3/4"	Nos. 8-9-10-11	3/4"	5/16"	5.00
3/16 x 1"	Nos. 9-10-11 Light	1"	5/16"	5.00
3/16 x 1"	Nos. 9-10-11 Heavy	1"	3/8"	6.00
3/16 x 1 5/8"	Nos. 9-10-11	1 5/8"	5/16"	6.25
1/4 x 1"	Nos. 12-13-14	1"	3/8"	5.60
1/4 x 1 1/2"	Nos. 12-13-14	1 1/2"	3/8"	8.00
5/16 x 1"	Nos. 15-16-17-18	1"	7/16"	6.25
5/16 x 1 1/2"	Nos. 15-16-17-18	1 1/2"	7/16"	10.00
3/8 x 2"	Nos. 20-22-24	2"	9/16"	15.00

INQUIRIES

Further information about Cinch Anchoring Specialties will gladly be furnished on request. Your inquiry, addressed to National Lead Company, Cinch Expansion Bolt Department, 111 Broadway, New York, N. Y. will receive prompt attention.

CAULKING LEAD

For the caulking of joints, particularly in cast iron bell and spigot pipe, lead is the material most frequently used. One of its advantages lies in the fact that it is soft and yielding, thus permitting a certain amount of movement in the pipe without leakage. If a leak does occur, the joint is easily repaired.

For caulking purposes, we furnish lead in two forms—ingot lead for cast lead joints and lead wool which is worked cold. Both products carry the Lead Industries' Association Seal of Approval—indicating that the lead is of the required purity for caulking purposes.

INGOT LEAD

Ingot lead is cast from selected grades of pig lead in 5-part sectional ingots, solid ingots or 25 lb. and 50 lb. pigs. The sectional ingots are specially designed for caulking purposes. Each section is easily detached from the others and fits the usual melting pot.

Since our ingot lead is made from selected metals, it is easy-flowing and soft which allows it to be readily caulked.

Workman pouring molten caulking lead into a joint in a cast iron water main.

APPROXIMATE QUANTITIES OF INGOT LEAD AND HEMP REQUIRED FOR C. I. PIPE JOINTS*

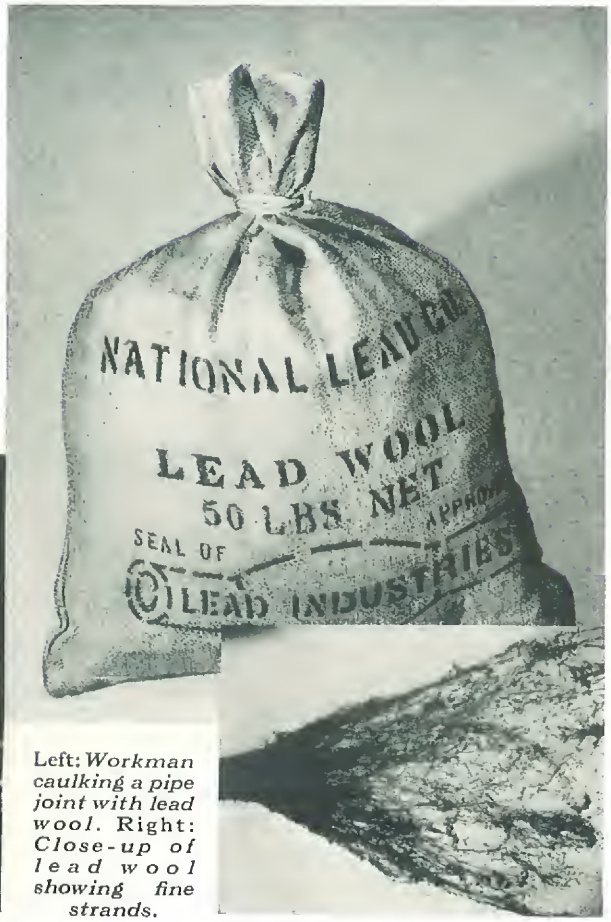
Size of Pipe	Lbs. of Lead per Joint 2 In. Thick		Lbs. of Hemp per Joint	
	Water	Gas	Water	Gas
3	6.00	.....	.18	.....
4	7.50	8.14	.21	.23
6	10.25	11.31	.31	.34
8	13.25	14.56	.44	.49
10	16.00	17.67	.53	.59
12	19.00	20.85	.61	.67
14	22.00	.....	.81	.....
16	30.00	27.20	.94	1.03
18	33.80	.....	1.00	.....
20	37.00	41.28	1.25	1.39
24	44.00	49.07	1.50	1.67
30	54.25	60.06	2.06	2.28
36	64.75	71.57	3.00	3.32
42	75.25	83.13	3.62	4.00
48	85.50	102.63	4.37	5.20
54	97.60	.....	6.25	.....
60	108.30	.....	8.25	.....
72	146.00	.....	12.50	.....
84	170.00	.....	15.00	.....

*From the Cast Iron Handbook (copyright 1927) published by the Cast Iron Pipe Research Association.

LEAD WOOL

Lead wool is formed from strands of lead twisted loosely into rope form. Many prefer it to ingot lead for caulking purposes because it requires no preheating and thus saves time and labor. Properly packed, lead wool makes a tighter and more flexible joint than a poured joint which tends to shrink slightly after casting. Also lead wool can be used under water, in wet ground or in other places where a cast joint is not practical.

Lead wool comes in 5 and 50 lb. bags or on reels. It runs about 2½ feet to the pound.



Left: *Workman caulking a pipe joint with lead wool.* Right: *Close-up of lead wool showing fine strands.*

APPROXIMATE QUANTITIES OF LEAD WOOL AND YARN REQUIRED FOR C. I. PIPE JOINTS

For Pressure up to 500 Lbs.

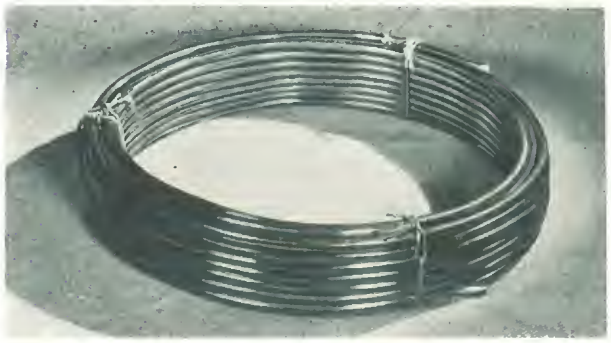
Lead Wool			Yarn	Lead Wool			Yarn
Diam. of Pipe	Depth—Inches	Weight—Lbs.	Depth—Inches	Diam. of Pipe	Depth—Inches	Weight—Lbs.	Depth—Inches
2	1	2	2	14	1¼	16	3
3	1⅛	3	2	15	1¼	18	3
4	1⅛	4.5	2	16	1¼	20	3
5	1⅛	5.5	2½	18	1⅜	22	3
6	1⅛	6.5	2⅝	20	1⅜	25	3⅜
7	1⅛	8.5	2⅝	24	1⅜	36	3⅜
8	1⅛	9	2¾	30	1½	45	3⅜
9	1⅛	11	2⅝	36	1⅝	60	3⅝
10	1⅛	12.5	2⅝	42	1⅝	75	3¾
12	1⅛	14	2⅝				

LEAD TUBING

Lead tubing is simply lead pipe of an extremely small bore and wall thickness. It is used for the compressed air lines in draught beer installations, gas stove connections, lightning-rod coverings, and in chemical plants. When hardened with antimony, it is employed extensively by player piano manufacturers and organ builders. For all these purposes, its chief advantages are flexibility and permanence.

We manufacture lead tubing, either from pure lead or from lead alloyed with tin or antimony. The stock sizes supplied are shown in the table below.

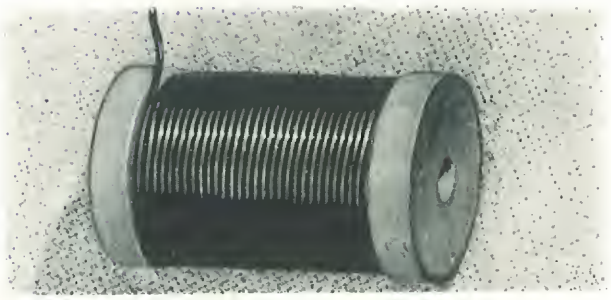
Lead tubing is usually shipped in coils or on reels. It is carefully packed or crated before shipment to guard against damage in transit.



STOCK SIZES OF LEAD TUBING

Inside Diameter	Outside Diameter	Weight Per Foot	Inside Diameter	Outside Diameter	Weight Per Foot
1/16"	1/8"	3/4 oz.	1/4"	13/32"	6 oz.
1/8"	13/64"	1 oz.	1/4"	7/16"	8 oz.
1/8"	3/16"	1 1/2 oz.	1/4"	1/2"	12 oz.
1/8"	1/4"	2 oz.	5/16"	3/8"	2 oz.
3/16"	1/4"	2 oz.	3/8"	7/16"	2 oz.
3/16"	5/16"	3 oz.	3/8"	1/2"	7 oz.
1/4"	11/32"	4 oz.	7/16"	1/2"	4 oz.
1/4"	3/8"	5 oz.			

LEAD WIRE



Lead wire is used in a variety of ways. In the smaller sizes, it is employed for bearing alignment work, for caulking, for electrical work and for spray guns in applying metallic coatings. Because of its pliability, non-rusting and non-corrosive qualities, nurseries make use of it for tying up vines and shrubbery. In the larger sizes it is usually referred to as burning bar or rod lead and is used in welding sheet lead. Alloyed with antimony, it is used by battery and brake-lining manufacturers. We sup-

APPROXIMATE NUMBER OF FEET PER POUND OF LEAD WIRE

Gauge No. American or Brown & Sharpe	Feet per pound		Gauge No. American or Brown & Sharpe	Feet per pound	
	Pure Lead Wire	6% Antimonial Lead Wire		Pure Lead Wire	6% Antimonial Lead Wire
1	3.09	3.22	16	100	104
2	3.89	4.05	17	126	132
3	4.90	5.12	18	159	166
4	6.19	6.45	19	201	209
5	7.80	8.15	20	253	264
6	9.85	10.3	21	319	333
7	12.4	13.0	22	402	419
8	15.7	16.3	23	507	529
9	19.7	20.6	24	640	667
10	24.9	26.0	25	806	841
11	31.4	32.7	26	1020	1060
12	39.6	41.2	27	1280	1340
13	50.0	52.0	28	1620	1690
14	62.9	65.5	29	2040	2120
15	79.4	82.8	30	2570	2680

ply lead wire in practically any gauge desired and of any specified composition. Our product is extruded under high pressure and is guaranteed to be uniform in diameter, true to gauge and free from irregularities or other defects. In addition to round wire, we also supply square, oval, half-round and other shapes on order. Lead or lead alloy wire is ordinarily furnished on reels. However, it will be cut into lengths and boxed, if desired.

TAPE LEAD

Tape or ribbon lead is an extruded product taking the form of long, thin strips of lead. It is used by manufacturers for stamping out products such as washers, dress weights, discs and the like. It is also used for caulking, flashing, patching and, in some instances, for tennis court markers.

Tape or ribbon lead is made up according to specification and is ordinarily furnished on reels. Our stock of dies is large enough to enable us to fill most orders for tape or ribbon lead without the necessity of making up new dies, thus insuring a lower cost and promptness in delivery.

LEAD GASKETS AND WASHERS

We can furnish lead gaskets in any thickness and outside diameter up to 11 feet. These are not a stock article and are made up only on receipt of orders accompanied by blueprints, templates or full specifications as to thickness, inside diameter and outside diameter.

Our stock of dies and punches is such that we can furnish lead washers of practically any size, both in the flat and the concave type.

HARDENING LEAD

Hardening lead is a pure lead, highly refined, for use in the hardening and tempering of steel. Our hardening lead is triple-refined to a purity of at least 99.995% true metallic lead. All lots can be depended upon to be of uniform purity. The lead is furnished in a double pig weighing approximately 50 lbs. The two sections are easily separated.

BAR AND PIG LEAD

We can furnish lead in pig or bar form cast from standard accepted brands of prime metal. The pigs weigh approximately 100 lbs; the bars according to specification.

PULVERIZED LEAD

Pulverized or "granulated" lead is used in several industries but chiefly in rubber manufacture. Our pulverized lead is made from standard brands of commercially pure lead. It is available in three sizes—50 mesh, 100 mesh and 200 mesh. Packed in 50 lb. tins; or in 450 lb. kegs.

LEAD SHOT

We manufacture drop and chilled shot in all standard sizes from .04″ diameter to .23″ diameter. We also manufacture compressed buck shot and lead balls ranging in diameter from .24″ to .68″. For air rifles, we make a special size of shot known and branded as "Air Rifle Shot." Having a diameter of .175″, it is designed for most makes of air rifles. Sold under the brand name "Tatham," our lead shot and lead balls are carefully manufactured to insure roundness, solidity, smooth polish and uniformity and accuracy as to size.

Drop and chilled shot and lead balls are packed in 5 and 25 lb. bags. Air Rifle Shot is sold in large or small tubes, packed 100 to the case. The large tube contains approximately 4 ozs. of shot; the small tube approximately 2¾ ozs. Air Rifle Shot is also furnished in 1 lb. cartons, packed 25 cartons to the case.

LEAD ROOF FLANGES

Lead roof flanges are preferred by many contractors to flanges made from other materials because they are durable, easy to install and readily adjustable to the roof pitch.

Our flanges are one-piece, high pressure castings of pure lead. They are guaranteed against imperfections common to the average flange such as blow holes, blisters, etc. An exclusive feature is a slightly stiffer apron which guards against possible leakage as a result of wind pressure and consequent curling of the apron away from the roof. These flanges are furnished in eight stock sizes as shown below.

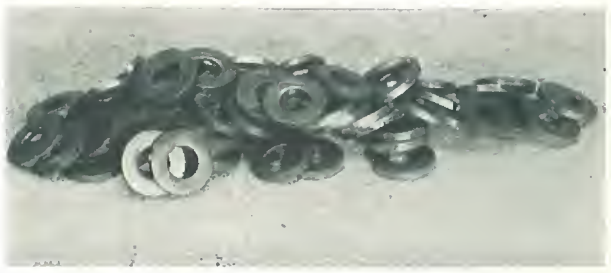
We are also in a position to furnish two-piece flanges made with extra long boots and larger size aprons to conform to government specifications.

PRICES AND SIZES OF STOCK ROOF FLANGES

SIZE	LIST PRICE	WEIGHT OF FLANGE	STOCK PACKAGE	SLEEVE LENGTH	SIZE OF BASE
1¼"	$1.25	3.00 lbs.	12	2⅝"	7 13/16" x 10½"
1½"	1.30	3.59 lbs.	12	2¾"	8⅛" x 10 13/16"
2"	1.50	3.69 lbs.	12	2⅝"	8⅝" x 11⅞"
2½"	1.60	4.48 lbs.	12	2⅞"	9¼" x 11 15/16"
3"	1.70	5.00 lbs.	12	2⅞"	9 5/16" x 13¼"
4"	2.00	6.18 lbs.	12	2⅞"	11 15/16" x 14⅝"
5"	3.00	8.50 lbs.	6	4⅛"	13½" x 16½"
6"	4.30	9.00 lbs.	6	4"	14½" x 17"

LEAD ROOFING WASHERS

We manufacture lead washers in practically any size and of any dimension desired. The stock sizes which we supply for roofing purposes are listed below. These washers are packed according to the customer's order either loose or in 5 lb. cartons, in 50 or 100 lb. boxes. When ordering, state quantity and method of packing desired.



STOCK ROOFING WASHER SIZES

NO.	SIZE HOLE	OUTSIDE DIAMETER	THICKNESS	APPROX. NO. TO POUND
1	1/8"	15/32"	.055"	268
2	5/32"	15/32"	.055"	263
3	3/32"	5/8"	.070"	117
4	3/16"	5/8"	.070"	118
*5	13/64"	5/8"	.070"	121
**6	1/4"	5/8"	.070"	125
10	5/16"	7/8"	.063"	70

*This size for 5/16" stove bolt. **This size for 1/4" stove bolt.

LEAD SASH WEIGHTS

Because lead combines great weight in a small area, it is effectively used for all types of counterbalances. One of the most familiar forms is the lead sash weight. For this purpose, it has the additional advantage of being non-rusting and quieter in operation than weights cast from other metals.

We manufacture both cast and extruded lead sash weights. Any size, any weight and practically any style sash weight can be furnished. Below is a table of the approximate weights per foot of cast and extruded weights in square and round styles.

SQUARE—CAST		ROUND—CAST	
Size	Weight	Diameter	Weight
1″	4¾ lbs.	1″	3¾ lbs.
1¼″	7¾ lbs.	1¼″	6 lbs.
1½″	11 lbs.	1½″	8¾ lbs.
1⅝″	13 lbs.	1⅝″	10 lbs.
1¾″	15 lbs.	1¾″	11¾ lbs.
1⅞″	17¼ lbs.	1⅞″	13½ lbs.
2″	19¾ lbs.	2″	15½ lbs.
2¼″	25 lbs.	2¼″	19½ lbs.
2½″	30¾ lbs.	2½″	24 lbs.
2¾″	37¼ lbs.	2¾″	29¼ lbs.
3″	44¼ lbs.	3″	34¾ lbs.
3¼″	52 lbs.	3¼″	40¾ lbs.
3½″	60½ lbs.	3½″	47½ lbs.
3¾″	69¼ lbs.	3¾″	54½ lbs.
4″	78¾ lbs.	4″	62 lbs.

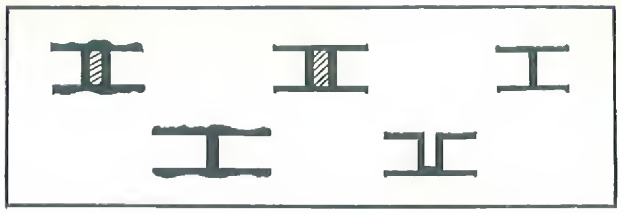
SQUARE—EXTRUDED		ROUND—EXTRUDED	
Size	Weight	Diameter	Weight
1¼″	7.06 lbs.	1¼″	5.50 lbs.
1¼″ x 1½″	10.24 lbs.	1½″	7.82 lbs.
1¾″	14.43 lbs.	1⅝″	9.78 lbs.
1¾″ x 2″	16.35 lbs.	1¾″	11.10 lbs.
2″	18.60 lbs.	1⅞″	12.83 lbs.
2″ x 2¼″	21.60 lbs.	2″	15.30 lbs.
2″ x 2½″	23.60 lbs.	2¼″	19.02 lbs.
2¼″	24.36 lbs.		
2½″	29.48 lbs.		

WEDGE LEAD

Lead wedges are used chiefly for justifying and aligning masonry, especially in such structures as monuments and tombstones. Driven into the irregular spaces left by the stones, they compensate for irregular settling and tend to absorb vibration.

We manufacture wedge lead, both plain and flanged, in all standard shapes and sizes. We will be glad to furnish further information as to other sizes and shapes we produce. Wedge lead is usually supplied wound on reels carrying 50 or 100 lbs. It can also be furnished cut in lengths.

LEAD CAMES



Lead cames or glazier's lead are grooved strips of lead used to support and hold together the panes of glass in leaded glass windows. They are produced by the extrusion process in a wide variety of sizes and patterns.

We manufacture a full line of lead cames in several different styles including round cames, flat cames, colonial cames, High Heart and T cames, and closed slot reinforced cames, a style used in work where the designer wishes to eliminate stay rods. A steel strip running through the central groove of the lead holds the work firmly in place. We also make cames in Antique, Rustic, Rough Cast, Hammered and Frosted designs.

All our cames are made from a grade of lead proved by experience to be the best for the purpose. They are milled so that the cement will take tight hold and prevent leaks. Our came lead is furnished in six foot lengths packed in boxes which weigh approximately 100 lbs., when packed.

STANDARD WEDGE LEAD SIZES

No. 1	3/16″ x 11/16″	Flanged	No. 7	1/4″ x 11/16″	Plain
No. 2	1/8″ x 9/16″	Flanged	No. 8	3/32″ x 7/16″	Plain
No. 3	5/32″ x 7/16″	Plain	No. 9	7/32″ x 1/2″	Plain
No. 4	5/32″ x 17/32″	Plain	No. 10	1/8″ x 1/2″	Plain
No. 5	1/8″ x 5/8″	Plain	No. 11	1/8″ x 3/8″	Plain
No. 6	1/8″ x 11/16″	Plain			

SOLDER

Solder is used in practically all trades and industries for the joining of metals such as tin, lead, copper, copper alloys, nickel, monel metal, iron, steel and stainless steel.

Soldering differs from welding in several respects. One of the chief distinctions between them is that in soldering, the metals to be joined are not heated to their melting points. Consequently, one of the requisites for a solder is that its melting point be lower than those of the metals it unites. Solder joins largely through its ability to adhere readily to the properly cleaned surfaces of other metals.

To insure adhesion in soldering, fluxes are necessary. Mild fluxes such as rosin, tallow or grease principally prevent oxidation of the metals being joined due to contact with the air or the hot solder. Active fluxes such as zinc chloride or some other chemical solution dissolve oxides already formed.

COMPOSITION

Solder is composed principally of lead and tin. Regardless of the proportions, it has a lower melting point than lead. When the tin content is 42½% or higher, it also has a lower melting point than tin.

When heated, solder does not change immediately from a solid to a liquid (except in the case of the eutectic alloy 62% tin—38% lead) but passes through an intermediate semi-liquid state. By varying the proportions of lead and tin, solders of differingmelting points and tensile strengths, and ranging from extreme fluidity to sluggishness during the semi-liquid state, are obtained.

Occasionally small quantities of other metals are added to solder to produce hardness, greater strength, brightness, a very low fusing point or some other special quality. The proper alloying of these other metals with lead and tin requires a high degree of manufacturing skill. Their presence in any considerable quantity in the average solder is usually considered a defect.

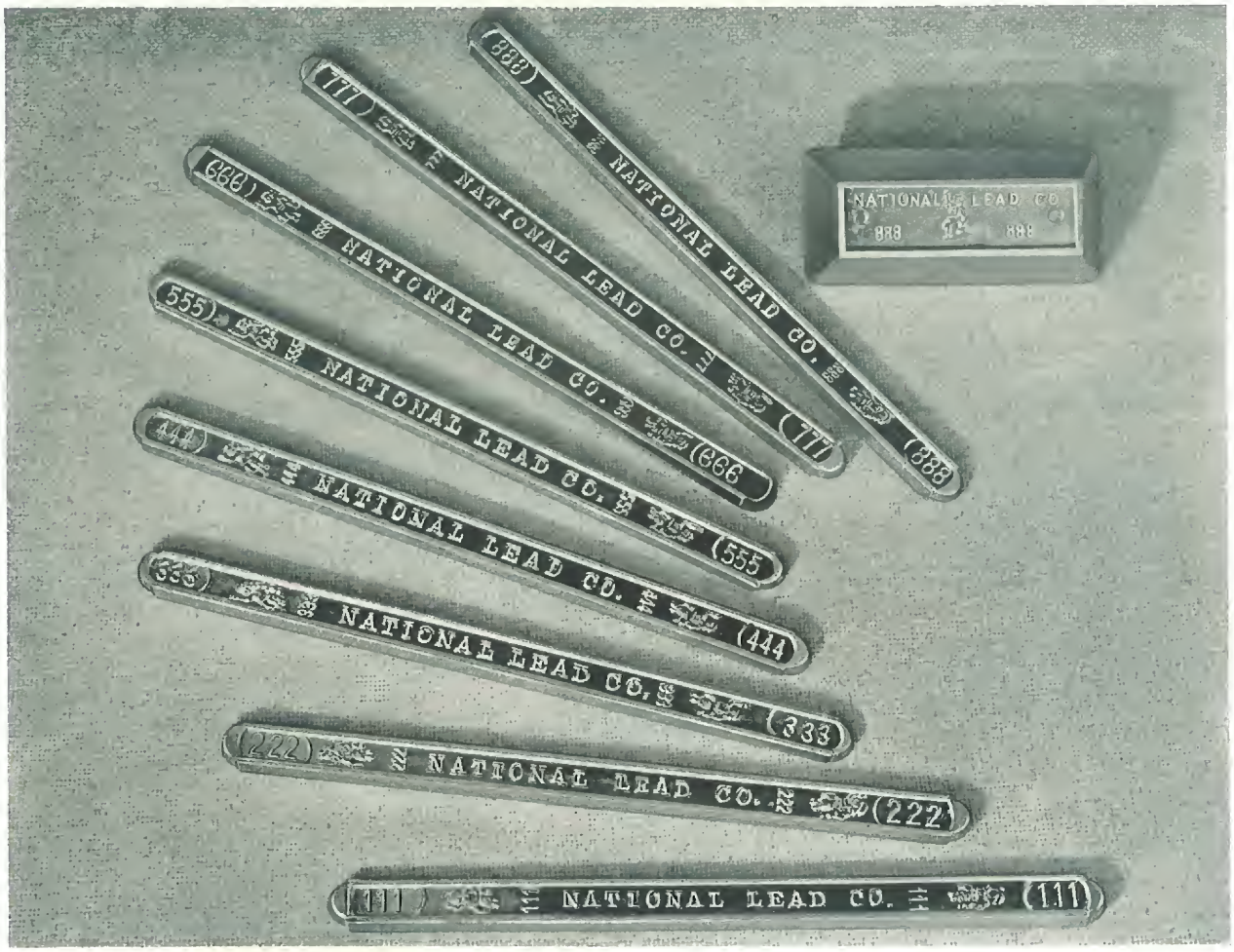
Above: *Pouring molten solder over a joint in a lead-covered telephone cable. As the solder cools to a plastic state, it is molded to shape with the "catch cloth."*

Below: *Finishing a wiped joint in lead pipe.*

SELECTION OF SOLDER

The selection of a solder depends largely on the method by which it will be applied, i.e. whether by wiping, sweating or the use of a blow-torch, soldering iron or solder bath. The method of application is, in turn, determined by the character of the metals to be joined, their size and position, the speed with which the operation must be completed and the shape, tensile strength and appearance required in the finished work.

Where the buyer does not have past experience to guide the selection or where doubts exist as to the suitability and economy of the solder now being used, the technical staff of National Lead Company will be glad to recommend the proper grade of solder to use.



OUR LINE OF SOLDER

We manufacture under the Dutch Boy trademark a complete line of solder, designed to meet a wide range of requirements. In addition to the bar solders shown above, the line includes two types of flux core wire solder and auto body solder shown on a succeeding page. We also manufacture solder without trademark in practically any form or of any composition desired by the user.

All solders we manufacture are guaranteed to be made only from pure, clean metals. They are carefully and accurately alloyed to insure uniformity at all times. They can be depended upon to be free of foreign substances tending to produce brittleness, discoloration or lack of adhesion.

DUTCH BOY BAR SOLDER

Dutch Boy bar solder is available in eight grades—each one of which is suitable for certain kinds of work and is designated by number. The grades with the lowest numerical designation contain the most tin.

DUTCH BOY III

This is the highest grade solder sold under the Dutch Boy trademark. It is guaranteed to be made of new lead and new tin, carefully mixed in equal parts (50% tin and 50% lead). Its melting range is 361°F–414°F.

Dutch Boy 111 is bright, strong and free from impurities. It flows easily, covers more area and has superior adhesion. It is widely used for new roofing work and is popular among tinsmiths, manufacturers and canners. Sold in bars weighing approximately 1½ lbs.

DUTCH BOY 222

Dutch Boy 222 is a smooth, free-flowing solder which contains slightly less tin than Dutch Boy 111. Its melting range is 361°F–424°F. It can be used wherever a bright, strong solder is wanted. Sold in bars weighing approximately 1½ lbs.

DUTCH BOY 333

Dutch Boy 333 is a composition suitable and popular for the general run of galvanized iron and sheet metal work, roofing and cornices. Its melting range is 361°F–437°F. It is made only from carefully selected tin and lead and flows freely. Sold in bars weighing approximately 1½ lbs.

DUTCH BOY 444

Dutch Boy 444 is a grade of solder which is known to the trade under the brand "Strictly Half and Half" although it actually contains more lead than tin. With a melting range of 361°F–437°F, Dutch Boy 444 is useful for heavy seamed work and is sometimes used for the reduction of better grades of solder. Sold in bars weighing approximately 1½ lbs.

DUTCH BOY 555

Dutch Boy 555 is suitable for many special requirements and is particularly adapted for plumbing work where a bright showy job is required. It can be used with an iron. Dutch Boy 555 has a melting range of 361°F–448°F. It is sold in bars weighing approximately 1½ lbs. and rectangular ingots weighing 5 lbs.

Above: *Solder being cast into bars.* Below: *Bars being removed from mold. Imperfect bars are discarded.*

DUTCH BOY 666

Dutch Boy 666, with a melting range of 361°F–460°F, flows freely but not quite as well as the finer grades. In electrical construction, tin can factories and for work of a similar character, it is the most thoroughly reliable and economical solder that can

be used. It is also a first-class dipping solder. Sold in bars weighing approximately 1½ lbs. and ingots weighing 5 lbs.

DUTCH BOY 777

Dutch Boy 777 contains an unusually large percentage of tin for solder of this grade. It has a melting range of 361°F–460°F. When used by plumbers for wiping it can be reduced slightly with more lead. Sold in bars weighing approximately 1½ lbs. and ingots weighing 5 lbs.

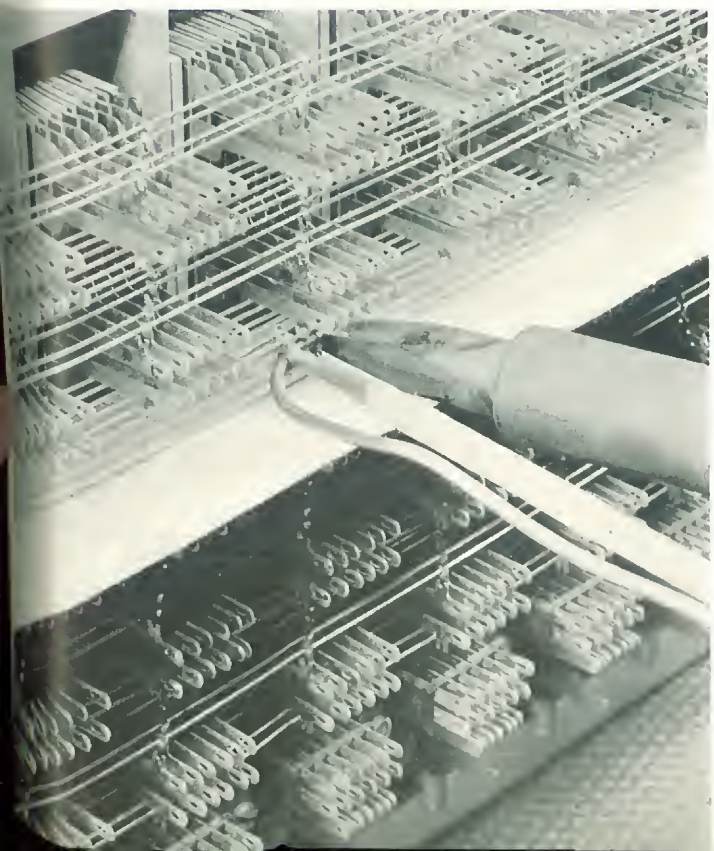
DUTCH BOY 888

Dutch Boy 888 is strictly a plumber's solder. It wipes a joint that will not sweat unless the solder is doped too heavily with lead. It has a melting range of 361°F–468°F and is sold in 1½ lb. bars and ingots weighing approximately 3 lbs.

APPROXIMATE DATA ON THE PHYSICAL PROPERTIES OF DUTCH BOY SOLDERS

No.	Ultimate Tensile Strength lbs./sq. in.	Elongation %	Shear Strength lbs./sq. in.	Impact Strength (Izod) ft. lbs.	Brinell Hardness No.	Density	Liquidus		Solidus	
							Cent.	Fahr.	Cent.	Fahr.
111	6400	40	5800	15.4	12.7	8.85	212	414	183	361
222	6600	40	5700	15.4	12.7	8.92	218	424	183	361
333	6400	41	5500	15.1	12.6	9.04	225	437	183	361
444	6600	40	5625	15.2	13.3	9.02	225	437	183	361
555	6700	39	5525	14.8	13.3	9.11	231	448	183	361
666	7000	35	5450	14.5	14.0	9.19	238	460	183	361
777	7000	33	5375	14.3	13.9	9.24	238	460	183	361
888	7000	30	5275	13.7	13.9	9.33	242	468	183	361

DUTCH BOY FLUX CORE SOLDERS



Dutch Boy Flux Core Solder is hollow solder wire filled with either an acid flux or a rosin flux. The former is suitable for general work wherever wire solder is considered the best form to use. The

Left: *Soldering a strap wire on a crossbar switch in a telephone installation. For soldering work of this type, flux core solder—furnishing solder and flux simultaneously—is ideal.*

Courtesy Bell Telephone Laboratories

latter is especially fine for electrical work, including radio.

Both Dutch Boy Rosin-Core Wire Solder and Dutch Boy Acid-Core Wire Solder are supplied in three sizes—1/8", 5/64" and 1/16". They are furnished on 1, 5, 10, 15, 25 and 50 lb. spools.

AUTO BODY SOLDER

This grade is a special solder designed for auto repair work. Containing only pure, clean tin and lead, it has the pastiness necessary for the proper filling of dents but will not run. It contains no hard spots, molds smoothly under a paddle and can be worked readily into narrow crevices and scores. The finished work will be tough and strong.

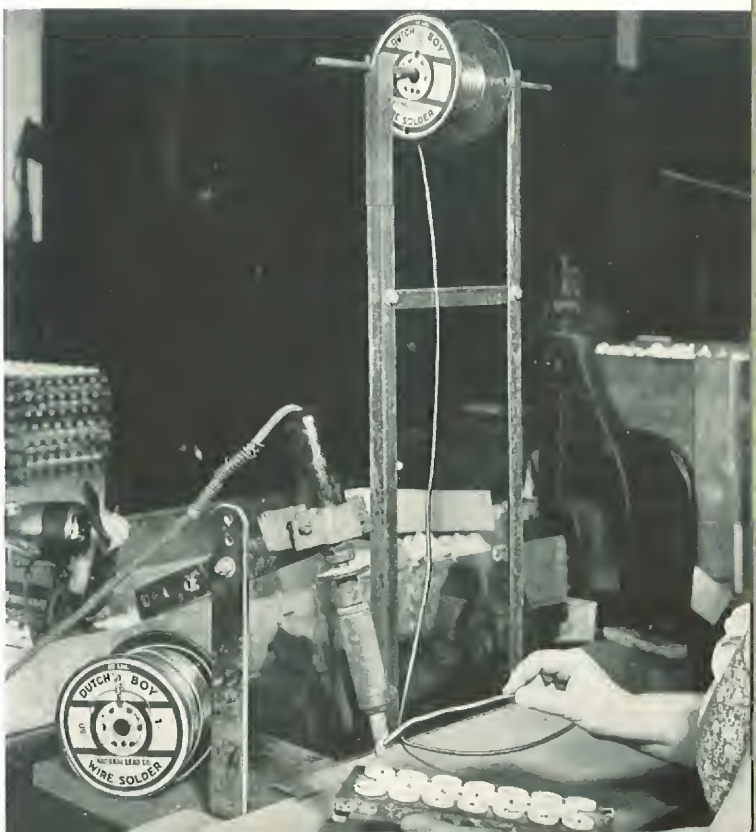
Auto Body Solder is furnished in 4 or 8-ounce bars. The latter are 3/8" square and 13" long. Both are packed in 25 lb. cartons. It can also be supplied in 1½ lb. bars, packed in 50 lb., 100 lb. or 250 lb. boxes, or in 1/4" round wire form cut in 13" strips for use in solder spray guns. The strips are packed in 25 lb. cartons.

SPECIAL SOLDERS

In addition to the solders shown on the preceding pages which are designed in composition and shape to meet average requirements, we manufacture solder in practically any form desired by

Right: *Soldering fuses with Dutch Boy wire solder. To insure continuous operation, the soldering iron is kept at the correct temperature by an electrical heating element.*

Courtesy Metropolitan Electric Mfg. Co



SOLDER WIRE GAUGES
(In Parts of an Inch)

Number of Wire Gauge	Brown & Sharpe		Birmingham or Stubs	
	Decimal	Fraction	Decimal	Fraction
22	.02534	1/40 F	.028	1/32 S
21	.02846	1/32 S	.032	1/32
20	.03196	1/32	.035	1/32 F
19	.03589	1/32 F	.042	3/64 S
18	.0403	3/64 S	.049	3/64 F
17	.04525	3/64 S	.058	1/16 S
16	.05082	3/64 F	.065	1/16 F
15	.05706	1/16 S	.072	5/64 S
14	.06408	1/16 F	.083	5/64 F
13	.07196	5/64 S	.095	3/32 F
12	.08081	5/64 F	.109	7/64
11	.09074	3/32 S	.12	1/8 S
10	.10189	7/64 S	.134	9/64 S
9	.11443	7/64 F	.148	5/32 S
8	.12849	1/8 F	.165	11/64 S
7	.14428	9/64 F	.18	3/16 S
6	.16202	5/32 F	.203	13/64
5	.18194	3/16 S	.22	7/32 F
4	.20431	13/64 F	.238	15/64 F
3	.22942	7/32 S	.259	17/64 S
2	.25763	1/4 F	.284	9/32 F
1	.2893	9/32 S	.3	19/64 F
0	.32495	21/64 F	.340	11/32 S
00	.3648	23/64 S	.380	3/8 F
000	.40964	27/64 S	.425	27/64 F
0000	.46	29/64 S	.454	29/64 F

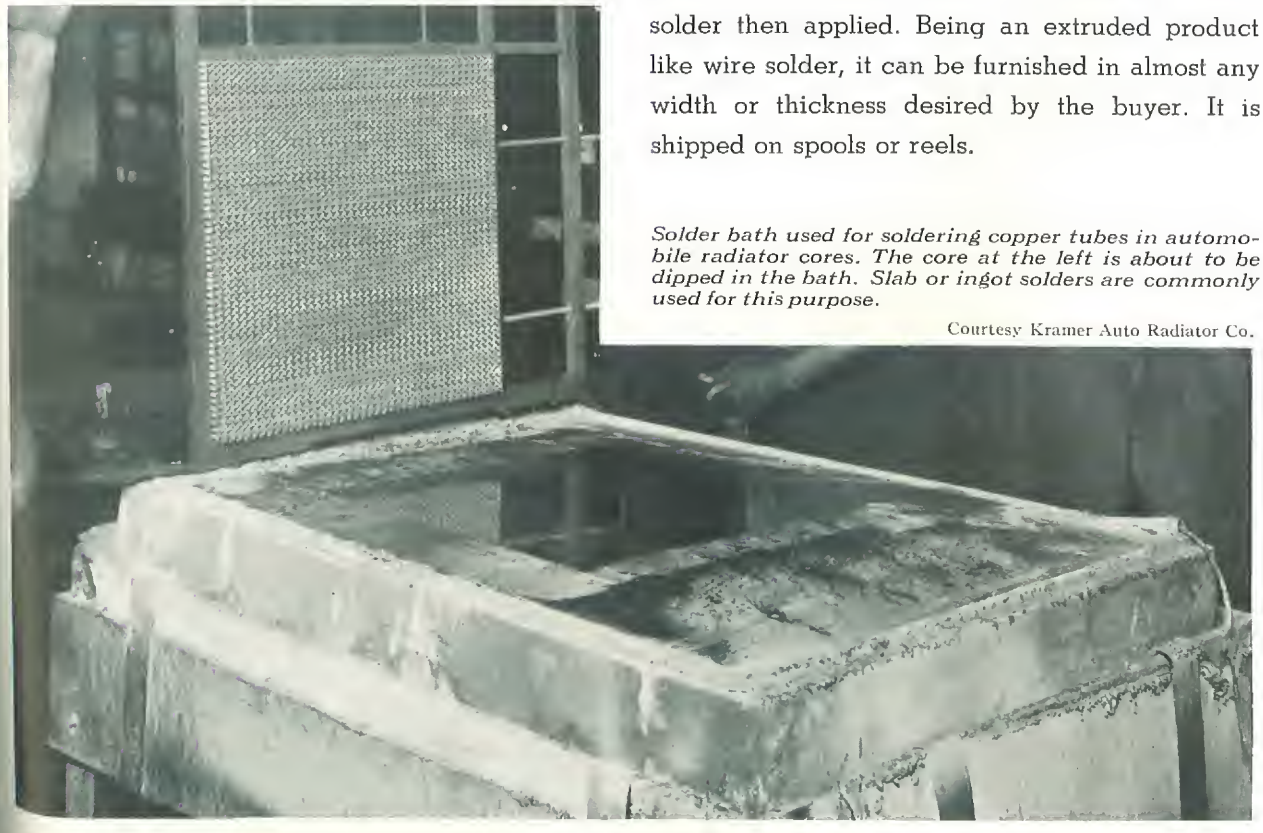
the user and alloyed according to any specified formula. A number of frequently specified types are described on the following pages.

Because of the great variety of shapes and compositions which may be supplied, special solders—with the exception of the more commonly used forms of solder wire—are not ordinarily kept in stock. However, our facilities for manufacturing solder are so complete that any order can be filled promptly.

Wire Solder—Wire solder is produced by an extrusion process. It can be supplied in practically any desired diameter from 1/40" to 29/64" and of any specified composition.

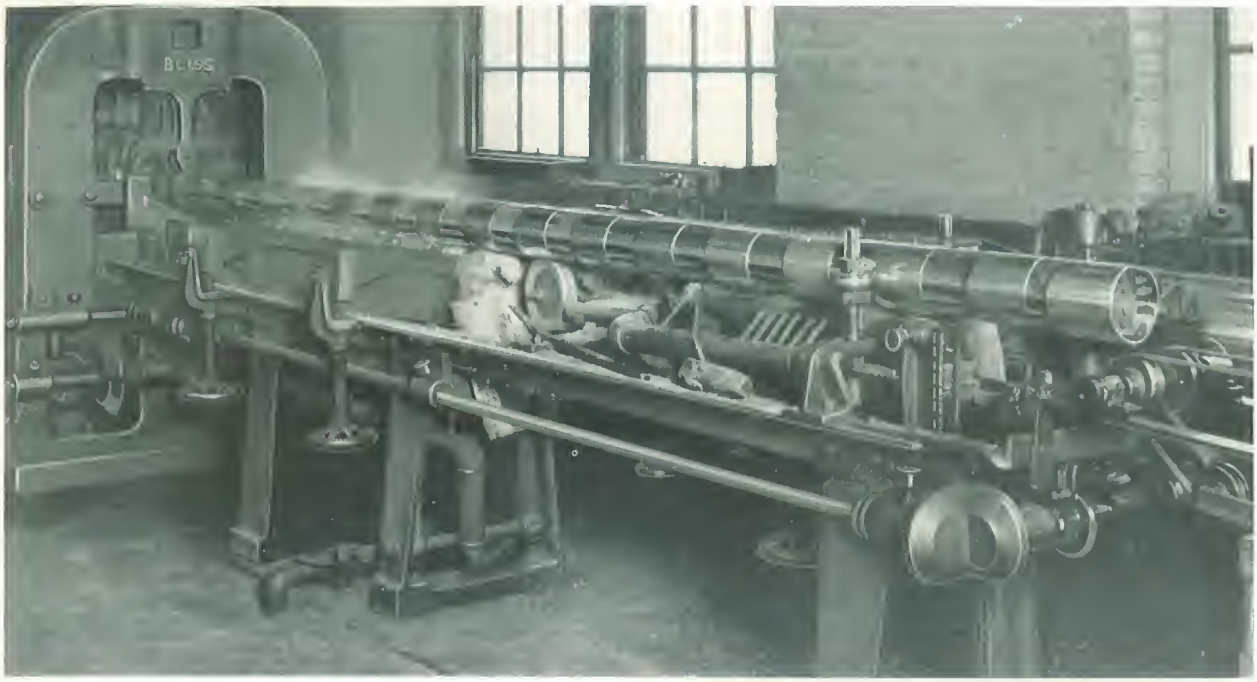
Our wire solder is carefully made to insure uniformity in gauge throughout the entire length. It is furnished on 1, 5, 10, 25, 50 and 65 lb. spools, or, if specified, in 5, 10, or 25 lb. coils, or, cut into segments. In ordering wire solder, use the gauge table at the left.

Tape or Ribbon Solder—Tape or ribbon solder is commonly used where the parts to be joined are preheated with a blow-torch and the solder then applied. Being an extruded product like wire solder, it can be furnished in almost any width or thickness desired by the buyer. It is shipped on spools or reels.



Solder bath used for soldering copper tubes in automobile radiator cores. The core at the left is about to be dipped in the bath. Slab or ingot solders are commonly used for this purpose.

Courtesy Kramer Auto Radiator Co.



Above: *Can soldering machine. As the can bodies leave the forming machine at the extreme left, they pass over the solder bath where short rolls apply solder to the seam.* Below: *Soldering top seam on a gas meter.*

Courtesy Lambert Meter Co.

Triangular Bar Solder—Triangular bar solder gets its name from its triangular shape which is found useful in many specialized types of soldering work. The bars usually measure 14″ in length with ¼″, 5/16″ and ⅜″ sides although other sizes are available. This form of solder is either cast or extruded according to the quantity ordered.

Drop Solder—Drop solder is triangular bar solder which has been cut into slices according to the specifications of the buyer. The slices can be cut to practically any thickness desired. When ordering drop solder, state the desired number of drops to the ounce or pound.

Tinner's Bar Solder—Tinner's bar solder is a cast product and is furnished in bars 12″ to 14″ long and usually ½″ to ¾″ wide and ½″ thick. It is a handy bar for soldering seams in certain kinds of tin work.

Meter Bar Solder—Meter bar solder is either cast or extruded according to the size of the order. It is rectangular in shape, usually about 14″ long, ⅜″ to ½″ wide and ¼″ to ⅜″ thick. It derives its name from the fact that it is widely used for seam soldering in the manufacture of gas meters.

Capping Bar Solder—This is a small cast bar

about ¼" x ¼" and 12" long. It is sometimes used by canners in place of drop or segment solder.

Solder Slabs—For solder baths, solder is usually supplied in slab form. The common sizes are 36" x 3" x 1", 24" x 3" x ¾" and 18" x 3" x ¾". They vary in weight from 15 to 35 lbs.

Pulverized Solder — Pulverized solder is useful for fine, delicate soldering work. This form is available in 50% tin and 50% lead or 40% tin and 60% lead compositions. Comes 50, 100 or 200 meshes to the square inch.

Sheet Solder—Any solder formula is also available in sheet form. The sheets are first cast and then rolled. It is available in sizes not larger than 24" x 36" and thicknesses from .010" to .100".

Low Melting Point Solder—Fusible alloys or low melting point solder usually contain in addition to lead and tin, various amounts of bismuth and cadmium. These alloys find important application in automatic safety devices for fire alarms controlling fires and heating equipment. They are also useful in soldering materials easily damaged by heat or for joining metals and vitreous materials.

We are in a position to furnish fusible alloys in any desired composition. The table below gives a few of the more widely used alloys.

Melting Point		Composition
° Cent.	° Fahr.	
47	116.6	Bi 40.9%—Pb 22.1%—In 18.1% Sn 10.7%—Cd 8.2%
70	158	Bi 49.4%—Pb. 27.7%—Sn 12.9% Cd 10%
91.5	196.7	Bi 51.7%—Pb 40.2%—Cd 8.1%
95	203	Bi 52%—Pb 32%—Sn 16%
102.5	216.5	Bi 54%—Sn 26%—Cd 20%
124.3	255.7	Bi 55.5%—Pb 44.5%
130	266	Bi 56%—Sn 40%—Zn 4%
138.5	281.3	Bi 57%—Sn 43%
142	288	Sn 51.2%—Pb 30.6%—Cd 18.2%
143	289	Bi 60%—Cd 39.3%—Zn 0.7%
144	291	Bi 60%—Cd 40%

MELTING POINTS OF LEAD-TIN ALLOYS

Composition		Melting Points				Composition		Melting Points			
Lead Per Cent	Tin Per Cent	Liquidus		Solidus		Lead Per Cent	Tin Per Cent	Liquidus		Solidus	
		Cent.	Fahr.	Cent.	Fahr.			Cent.	Fahr.	Cent.	Fahr.
100.0	0.0	327	620	327	620	47.5	52.5	206	403	183	361
97.5	2.5	320	608	310	590	45.0	55.0	200	392	183	361
95.0	5.0	314	597	300	572	42.5	57.5	194	381	183	361
92.5	7.5	308	586	290	554	40.0	60.0	188	370	183	361
90.0	10.0	302	576	275	527	37.5	62.5	183	361	183	361
87.5	12.5	296	565	250	482	37.0	63.0	181	358	183	361
85.0	15.0	290	554	225	437	35.0	65.0	182	360	183	361
82.5	17.5	285	545	200	392	32.5	67.5	184	363	183	361
80.0	20.0	280	536	183	361	30.0	70.0	186	367	183	361
77.5	22.5	274	525	183	361	27.5	72.5	189	372	183	361
75.0	25.0	268	514	183	361	25.0	75.0	192	378	183	361
72.5	27.5	262	504	183	361	22.5	77.5	195	383	183	361
70.0	30.0	257	496	183	361	20.0	80.0	199	390	183	361
67.5	32.5	252	486	183	361	17.5	82.5	202	396	183	361
65.0	35.0	247	477	183	361	15.0	85.0	205	403	183	361
62.5	37.5	242	468	183	361	12.5	87.5	210	410	183	361
60.0	40.0	238	460	183	361	10.0	90.0	213	415	183	361
57.5	42.5	231	448	183	361	7.5	92.5	218	424	183	361
55.0	45.0	225	437	183	361	5.0	95.0	222	432	183	361
52.5	47.5	218	424	183	361	2.5	97.5	227	441	183	361
50.0	50.0	212	414	183	361	0.0	100.0	232	450	232	450

BEARING METAL

Bearing metal or babbitt is a general term used to describe a group of alloys of widely varying composition which are used to line machinery bearings. Their function is to reduce friction and save the shaft from injury.

FACTS ABOUT BEARING METAL

There are two varying requirements in a bearing metal. The first is an adequate resistance to pressure so that it may properly sustain the load put upon it in service. The second is the ability to (1) conform to irregularities in the shape or alignment of the shaft and (2) return readily to a smooth surface after being cut or roughened by foreign substances which may get into the bearing. The first requirement is met by a proper degree of hardness and crushing strength. The second is met by a proper degree of malleability.

Other important requirements of a bearing metal are: a low frictional coefficient, a relatively high melting and softening point, and the ability to resist the corrosive action of acids which may form in the lubricating oil at high temperatures.

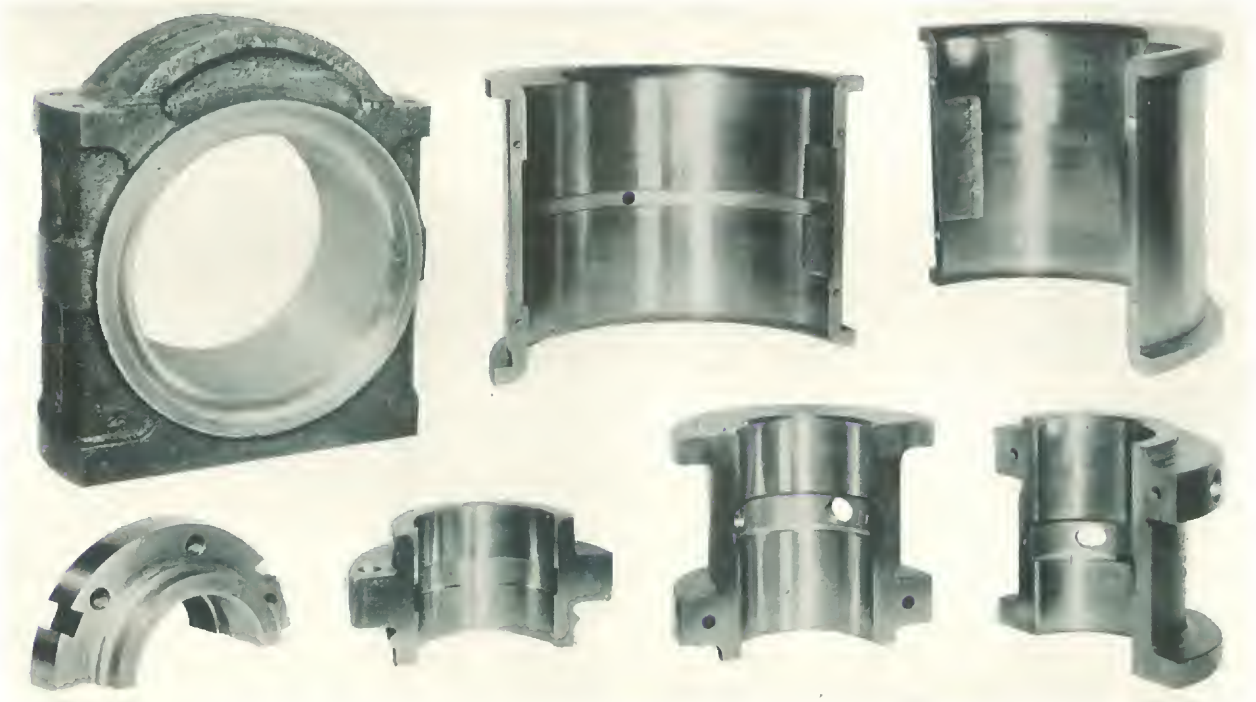
COMPOSITION

The chief constituents of babbitt metal are tin, lead, antimony and copper. The alloys commonly used range from those having a high percentage of tin, with small amounts of copper and antimony and no lead, through intermediate grades containing all four metals to the lower grades which have a high lead content and no tin.

SELECTION OF BEARING METAL

The selection of a babbitt metal depends entirely on the nature of the service it must perform in the bearing.

Where bearings are subjected to heavy loads, high speeds and high temperatures, the use of a better grade "tin-base" babbitt is called for. These alloys are comparatively hard and have a high



Several types of babbitt-lined machinery bearings.

compressive strength, but are tough and not brittle. Furthermore, while tin has a lower melting point than lead, the tin-base alloys are always hardened with a fairly high percentage of copper which means they are never completely fluid until subjected to a temperature 200°-300° above the solidification point. In consequence they retain their hardness better at high frictional heats.

Where bearings are subjected to high speeds but little strain, an intermediate alloy, composed of more nearly equal parts of tin and lead, is satisfactory. These alloys melt at a lower temperature than either the tin-base or the lead-base alloys and, therefore, lose their hardness and strength to a greater degree with rise of temperature and under friction. In this respect, they are not such good bearing metals as the other alloys, although they find use in very thin linings where their superior fluidity combined with their property of adhering firmly to a tinned bronze or steel backing is of advantage and where lack of strength is not objectionable.

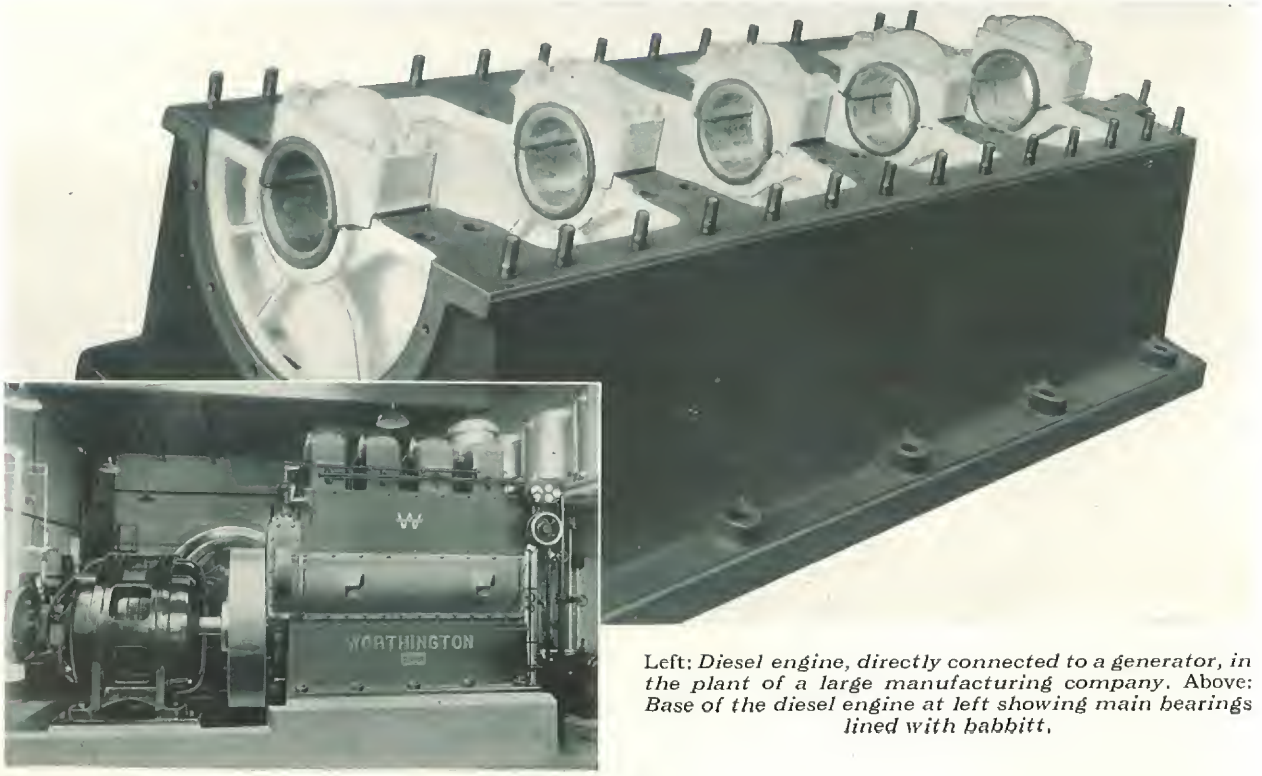
For bearings operating at low speed and carrying little weight, a lead-base alloy will suffice.

OUR LINE OF BEARING METAL

Under the Dutch Boy and Hoyt Metal Co. trademarks, we manufacture a complete line of bearing metals designed to fill most bearing requirements. The approximate physical properties of these alloys as well as a general indication of the types of bearings in which they are commonly used will be found on the following pages.

In addition to our branded metals, we are equipped to furnish special alloys in accordance with customers' formulas. We also make analyses of samples and furnish bearing metals which duplicate these analyses.

Our bearing metals are ordinarily furnished in an easily handled ingot form. However, we can supply babbitt in any shape desired, either cast or extruded in wire form for use in spray guns.



Left: *Diesel engine, directly connected to a generator, in the plant of a large manufacturing company.* Above: *Base of the diesel engine at left showing main bearings lined with babbitt.*

DUTCH BOY BEARING METALS

The bearing metals sold under the Dutch Boy trademark cover a wide range of uses and needs. They are carefully and expertly alloyed from pure, clean metals. All the grades are cast in round-bottom molds. The ingots fit an ordinary ladle.

DUTCH BOY PHOENIX METAL

This bearing metal is the top grade in our Dutch Boy line. It is recommended for heavy work and high speed machinery.

When melted, Phoenix Metal is very fluid and can readily be run into the smallest boxes. It is tough, hard and elastic. Where great ductility is required—for example, in cases where the hammering action caused by the play of the shaft may bring about fracture in the lining material—Dutch Boy Phoenix is distinctly superior. Phoenix Metal is especially adapted for crank pins, cross-heads, main bearing and pillow-blocks of large shafts, in automobiles, dynamos, marine engines, gang saws, rock crushers, etc.

DUTCH BOY HEAVY PRESSURE METAL

This alloy, like Dutch Boy Phoenix, is designed for the highest grade work and, like Phoenix, contains no lead. Its special characteristic is great resistance to crushing strain. It will stand the most severe pounding without squeezing out. It is harder than Phoenix, and for that reason is to be preferred for some purposes.

Because it contains no lead and has a high percentage of copper, Dutch Boy Heavy Pressure Metal melts at a high temperature, is easily chilled, and retains its hardness at the highest temperatures at which bearings operate.

In melting, Heavy Pressure requires more heat than Phoenix to bring it to a perfectly fluid condition. Consequently, it cannot be so readily poured into a very thin bearing. Heavy Pressure is preferred to Phoenix where the design of bearings is such that an excessive pressure per square inch of bearing surface is developed. In such cases it fre-

Babbitt-lined machinery bearings grouped around a jig and mold set-up for casting linings.

quently pays to sacrifice the greater fluidity and malleability of Phoenix for the sake of the extra resistance to unusually severe pressure.

DUTCH BOY GENUINE BABBITT METAL

Dutch Boy Genuine Babbitt Metal is made exactly according to Isaac Babbitt's formula patented in 1839. It analyzes as follows: tin 88.9 per cent, antimony 7.4 per cent, copper 3.7 per cent. The Dutch Boy trademark on this alloy constitutes a definite guarantee that its composition is as stated. This is important because the term "genuine babbitt" has been applied at times to alloys which vary more or less widely from the original formula.

DUTCH BOY NO. 1 JOURNAL METAL

This metal is compounded expressly for large bearings where the pressure, though heavy, is steady—on heavy engine and general mill work, for instance.

While Dutch Boy No. 1 Journal will stand practically as much crushing strain as Dutch Boy Phoenix or Dutch Boy Heavy Pressure, its melting point is much lower and it will not do the work of Phoenix or Heavy Pressure when subjected to excessive speed. However, it retains a high degree of hardness at 212°F, a temperature often reached by bearings in operation, being exceeded in this respect only by Heavy Pressure.

Dutch Boy No. 1 Journal is easily poured, with very little shrinkage. It is good for use in steam winches and other hoisting machinery.

DUTCH BOY STERLING JOURNAL METAL

This is a copper-hardened metal, high in tin, capable of resisting considerable crushing strain. It is the grade used largely in stationary gas engines and for other equipment in many fields where a lower-priced metal than Dutch Boy Phoenix is desired, and yet one that will do satisfactory work, except under the most severe service. Its desirable qualities are fluidity superior to the tin-base alloys containing more copper, and the property of adhering better than the alloys containing more lead.

DUTCH BOY PERFECTION ANTI-FRICTION METAL

Perfection Anti-Friction Metal is a copper-hardened alloy which sells at a popular price. It has an unusual resistance to crushing strain for this

grade of metal, and its hardness at 212°F is ample for normal requirements.

Due to its low melting and liquefaction points, Perfection Anti-Friction will be found to be an easy handling metal, flowing freely at less than 500°F. It peens easily and oil clings tightly to its surface.

Except where the most excessive strains and the highest speeds are developed, this alloy is recommended for all types of machinery.

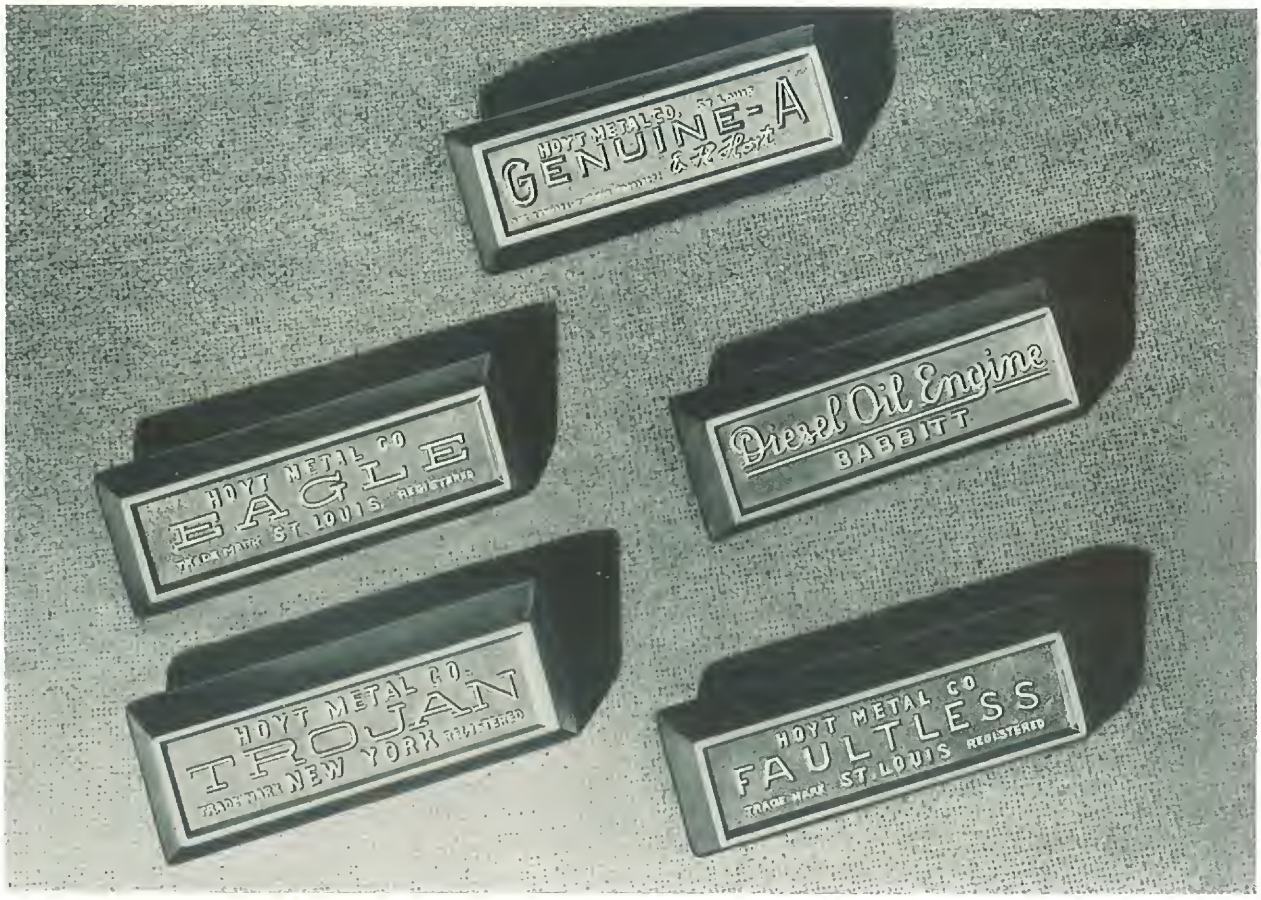
DUTCH BOY BEARING METAL

This metal is used satisfactorily on many kinds of machinery and general mill work. It is the exact equivalent of many anti-friction metals sold at double its price. Dutch Boy Bearing Metal is adapted for pulleys, hangers, line shafting and slow-moving machinery.

Pouring a babbitt lining. This method, used in many machine shops, is usually employed for the smaller bearings.

APPROXIMATE DATA ON THE PHYSICAL PROPERTIES OF DUTCH BOY BEARING METALS

Grade	Phoenix	Heavy Pressure	Genuine Babbitt	No. 1 Journal	Sterling Journal	Perfection Anti-friction	Bearing Metal
Specific Gravity	7.478	7.526	7.477	7.637	8.810	9.878	10.116
Wgt. Lbs. Per Cu. In.	.270	.272	.269	.276	.318	.357	.365
Solidus—°Cent.	234	238	238	185	184	244	239
—°Fahr.	453	460	460	365	363	471	462
Liquidus—°Cent.	371	407	362	291	346	257	260
—°Fahr.	700	765	684	556	655	495	500
Proper Pouring Temp. (°F.)	825	890	809	681	780	620	625
Tensile Tests							
Ult. Str. Lbs./Sq. In.	9,460	12,280	10,910	12,760	9,325	11,557	9,100
Elongation %	16.8	6.3	14.9	3.3	1.4	2.6	3.8
Compressive Strength (App. Deformation of Cyl's. 1″ Dia. x 2″ High at 70 F.)							
At 1,000 Lbs./Sq. In.	.0001″	.0000″	.0000″	.0005″	.0002″	.0001″	.0001″
At 5,000 Lbs./Sq. In.	.0017″	.0004″	.0015″	.0023″	.0014″	.0043″	.0040″
At 10,000 Lbs./Sq. In.	.0800″	.0080″	.0120″	.0180″	.0306″	.0311″	.0300″
Brinell Hardness							
At 20°C.— 68°F.	24.0	32.3	26.7	32.4	23.3	27.5	23.5
50°C.—122°F.	18.1	24.7	20.8	20.8	14.1	19.9	17.3
100°C.—212°F.	12.2	16.0	12.2	15.0	10.9	13.6	11.9
150°C.—302°F.	8.1	11.3	8.1	10.0	6.4	11.3	7.5
200°C.—392°F.	4.5	5.9	4.9			3.4	3.4
Brinell No. at 20° C. after annealing 28 days at 100° C.	23.1	31.5	25.4	28.4	20.0	23.0	19.1



HOYT BRAND BEARING METALS

Babbitt metals carrying the name "Hoyt Metal Co." have been known and used in the trade for more than a half century. Carefully made from pure, clean metals, these alloys are recognized as standard, high grade babbitts everywhere. Several of the more popular brands are described on this and the following page.

GENUINE-A BABBITT METAL

Hoyt's Genuine-A has been the standard for many years in all types of machinery where a high grade babbitt is necessary. It is being successfully used in babbitting the bearings of electrical machinery, locomotive cranes, steam shovels, concrete mixers and other machinery where a heavy load is distributed over a comparatively small bearing surface or where excessively high speeds are developed.

DIESEL OIL ENGINE BABBITT

This grade of babbitt is especially alloyed with a view to withstanding the extreme pressure caused by impact in the largest of the diesel type engines. Due to its extreme toughness and low coefficient of friction, it is a reliable babbitt for use in marine or industrial installations of internal combustion engines. It is also well suited to give dependable service under the high speed and the heavy pressures encountered in aircraft and automotive motors. It may be used in the form of a poured or die cast bearing or the lining of a bronze shell.

TROJAN BABBITT METAL

Trojan Babbitt has been used successfully as a substitute for genuine babbitt in steam engines, motors, internal combustion engines or other types of equipment where the service required is not excessive.

It is also used extensively in hoisting engines, dredging machinery, tractors and harvesting machinery.

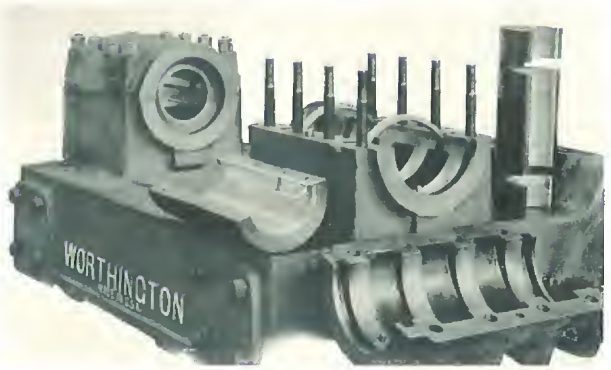
FAULTLESS-A BABBITT

This bearing metal is a scientifically alloyed mixture of lead, tin, antimony and copper. It is designed for use in sawmill and other woodworking machinery subject to sudden and intermittent strain.

The extreme fluidity of Faultless-A Babbitt insures better adherence to either a bronze or steel backing than is possible with the ordinary lead-base babbitt. This is true when even very thin linings are being cast.

EAGLE-A BABBITT

Eagle-A Babbitt is a popular priced lead-base bearing metal suitable for many types of general service. It has been used with complete satisfaction in machine shops, cotton gins, harvesting and woodworking machinery, under comparatively heavy loads and high speed. On the basis of its performance, this alloy can safely be called superior to many other brands which sell for a higher price.



Above: *Ring oiling pinion shaft bearings on a horizontal power pump (housing in foreground removed to show rings.)*

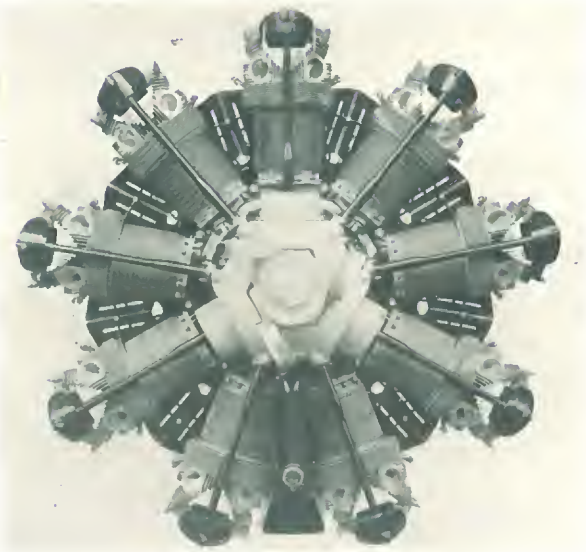
HOYT'S STANDARD NO. 4

This grade is a standard utility babbitt made from selected metals and suitable for line shaft and other installations where the load is not excessive and the bearing is not subjected to sudden strain.

APPROXIMATE DATA ON THE PHYSICAL PROPERTIES OF HOYT BRAND BEARING METALS

Grade	Genuine-A Babbitt	Diesel Oil Engine	Trojan Babbitt	Faultless-A Babbitt	Eagle-A Babbitt	Standard No. 4
Specific Gravity	7.34	7.46	7.75	9.005	10.04	10.67
Wgt. Ozs. Per Cu. In.	4.24	4.31	4.48	5.20	5.8	6.17
Solidus—°Cent.	225	238.8	187	184.4	243	247
—°Fahr.	437	462	368.6	364	469.4	476.8
Liquidus—°Cent.	371	422	282	292.2	260	265
—°Fahr.	699.8	791.6	539.6	558	500	509
Proper Pouring Temp. (°F.)	824	916	700	683	625	634
Compressive Strength (App. Deformation of Cylinders, 1¼" Dia. x 2½" High at 70°F.)						
At 1,000 Lbs./Per Sq. In.	.0000	.0000	.0005	.0012	.0020	.0025
5,000 Lbs./Per Sq. In.	.001	.0005	.0023	.0040	.0090	.0170
10,000 Lbs./Per Sq. In.	.015	.013	.0104	.0140	.0620	.2850
Brinell Hardness						
At 21° C.— 70°F.	28.6	34.4	27.4	21.8	23.5	14.3
100° C.—212°F.	12.8	15.7	11.2	8.2	11.9	6.4

HOYT NUMBER ELEVEN METAL



Hoyt Number Eleven Metal is being successfully used on bearings of the "Bristol" engines which power Great Britain's Imperial Airways' flying boats.

Hoyt Number Eleven Metal is a high-grade babbitt, specially designed for use in equipment where the service is exceptionally severe—for example, in aircraft engines, where fairly heavy loads must be sustained for long periods at high speeds.

Hoyt Number Eleven Metal has high anti-frictional qualities and exceptional toughness. It retains its hardness and resistance to crushing strain to a considerable degree even at elevated temperatures.

This alloy is being successfully used, not only in aircraft engines, but in marine engines, steam turbines, and other large equipment where bearings are subjected to high speeds and either constant or intermittent loads.

SATCO-LINED BEARINGS

National Lead Company, through its subsidiaries, the Magnus Metal Corporation and the American Bearing Corporation, manufactures and sells bearings lined with Satco Metal* for use in diesel engines, steam and electric locomotives and cars, and for various types of machinery.

The lining metal used in these bearings is a patented alloy developed especially to meet modern service conditions where bearings are subjected to unusually high speeds and heavy loads. It is being used successfully in railway work as a lining for truck and trailer brasses, car journal bearings, cross-head gibs, etc. It has also proved superior to standard composition alloys in internal combustion engines and for various other types of machinery.

Satco Bearing Metal combines the hardness of the most costly white metal alloys with the advantage of an initial melting point 100° F. higher. It has a solidification temperature of 563° F. and a complete liquefaction temperature of 788° F. This quality is important as it greatly increases the resistance of the lining to failures due to a breakdown of lubrication in service.

Another outstanding characteristic of Satco Bearing Metal is its high resistance to transverse stresses, a quality which minimizes the tendency of the lining to crack or deform under heavy loads.

*Reg. U. S. Pat. Off.

DATA ON SATCO BEARING METAL

	Satco	Tin-Base Babbitt	A. A. R. Lining Metal
Brinell Hardness			
At 70° F.	23.8	22.2	17.8
150° F.	19.7	17.2	13.2
212° F.	17.2	12.9	9.5
300° F.	12.0	7.6	4.2
350° F.	9.6	3.5	†
400° F.	7.7	*	†
Ult. Compressive Str. Lbs./Sq. In.			
At 70° F.	16,300	17,200	15,600
150° F.	12,300	11,200	9,500
212° F.	10,200	7,500	6,100
300° F.	7,000	4,000	2,700
400° F.	3,700	2,000	1,200

†Metal too soft to determine hardness.

TYPE METALS

Type metals—the group of lead-base alloys used by job printers, publishers and trade compositors for the casting of type and printing plates—are unique among metal products in one respect. Constantly being melted and reused, they require intelligent servicing. The working stock must be "toned up" with new metal from time to time. Periodic analyses of composition are necessary.

For this reason, the experienced buyer of type metal usually prefers to buy from a concern which not only furnishes high grade metal but is able and willing to help him care for the metal properly.

National Lead Company has been supplying type metal to the printing trade for a good many years. Its sales and technical staffs are thoroughly familiar with printing equipment and the proper care of type metal. They are ready and willing at all times to render advice and assistance in the solution of metal problems.

Furthermore, a complete type metal service plan is available. When desired, customers' metal stocks are carefully analyzed at regular intervals, dross exchanged and the correct toning metal sent to maintain an efficient, properly proportioned working supply.

As described on this and the following pages, National Lead Company manufactures a complete line of type metal designed to fill every type or plate casting requirement. Each alloy is made from pure, clean metals to insure that it will be free-flowing, have good casting qualities and a low rate of drossing. Moreover, National Lead Company's type metals can be depended upon to be always uniform in quality and composition.

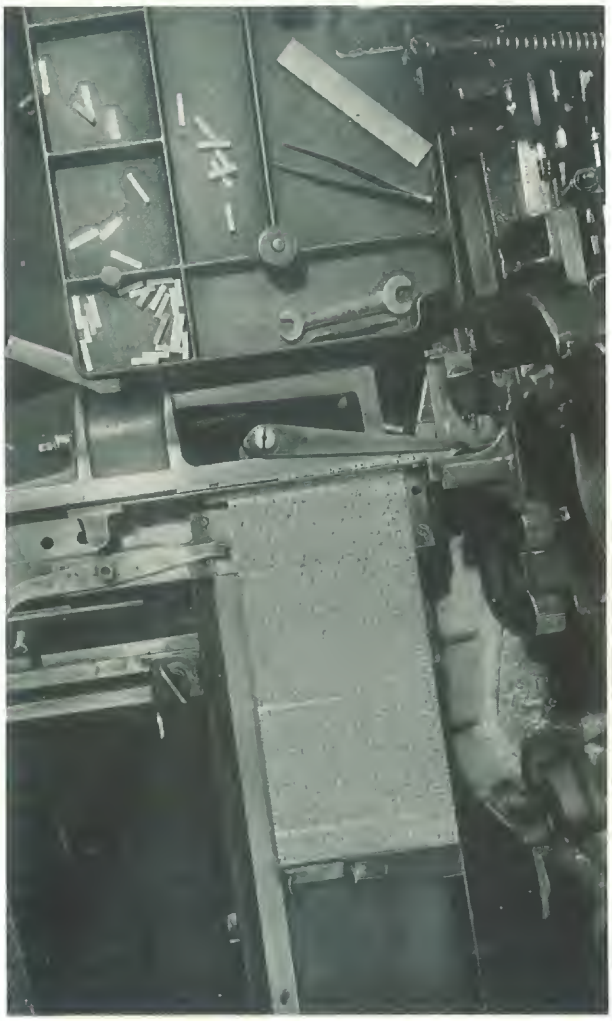
The good casting quality of our linotype metal insures sharp, clean type.

LINOTYPE METAL

Linotype metal contains lead, tin and antimony. The tin contributes toughness, and the antimony contributes hardness. Good linotype metal must be made from absolutely clean metals. It should be free-flowing and have desirable surface tension. The presence of all these qualities insures the casting of sharp, clean type.

While linotype metal is used principally on Linotype, Intertype and Ludlow machines which cast a single slug, it is also used on Monotype Strip Material and Elrod machines, casting either rule borders or spacing material. In some newspaper plants, it is also used for the casting of flat printing plates from mats.

Linotype metal is carried in stock in three-sectional ingot bars and is packed in 250-lb. cases. It is also available in bars, suitable for use in automatic feeders.



Above: *Casting unit of the monotype typesetting machine delivering type.* Below: *Casting and cutting stereotypes. The metal is heated in the immersion gas-fired pot in the background.*

MONOTYPE METAL

Monotype metal is alloyed from the same metals as linotype metal although it contains a larger percentage of tin which increases its strength, and a larger percentage of antimony which makes it harder. This alloy is used principally on monotype machines which cast single letters or characters.

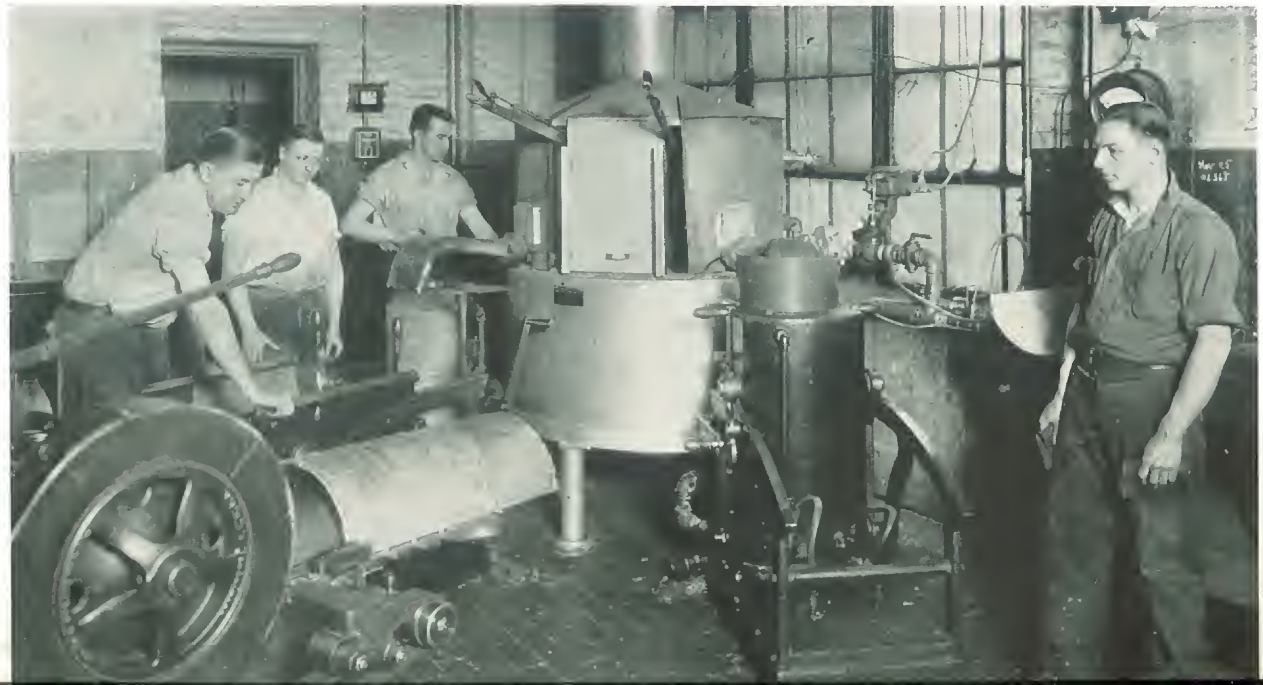
However, our monotype metal is sufficiently hard to be used, not only on monotype machines, but also on the Monotype Sorts Caster for casting hard type, usually in the larger sizes, for hand assembly.

Monotype metal is furnished in ingot form. The ingots weigh approximately 1¼ lbs. each and are packed in 250-lb. cases.

STEREOTYPE METAL

Stereotype metal is alloyed from the same metals as linotype and monotype metal. Ordinarily its hardness is about midway between the two.

The principal uses for stereotype metal are in casting the curved plates used in newspaper printing and in casting flat plates from the mats supplied to newspapers. However, many printers are now buying stereotype equipment for the casting of plates in general work. Stereotyping is a simple process and, where repeat orders are contemplated, from small catalogs, letterheads, etc., the stereotype matrix is kept in stock, avoiding the



necessity of tying up expensive foundry type awaiting further orders. Some magazines are now using nickel-faced stereotypes for long runs.

Stereotype metal comes cast in pigs weighing from 50 to 65 lbs. each. For the customer with small stereotype equipment, we will cast smaller ingots if desired.

SORTS CASTER METAL

Sorts Caster metal is a hard monotype metal which contains, in addition to tin and antimony, a small percentage of copper. It is widely used in Monotype and other Sorts Casters. The type produced is in every way comparable to foundry type.

Sorts Caster metal comes cast in ingot form and packed in 250-lb. cases.

COMBINATION METAL

Combination metal is a special alloy midway between linotype metal and stereotype metal. It is designed particularly for use in shops where it is not considered desirable or feasible to maintain two remelting pots—one for Linotype and the other for Stereotype.

Combination metal is furnished in ingot form.

Our Sorts Caster metal produces type comparable in all respects to foundry type.

ELECTROTYPE METAL

Electrotype metal is a "backing" metal and is used to give body to a copper or nickel-faced electrotype. While it is alloyed from the same ingredients as the type metals—lead, tin and antimony—the latter two are present only in small quantities.

In commercial electrotype plants, the metal, of course, is not reused. In publishing houses and among large job printers, however, the backing metal is frequently melted from the nickel or copper shell and used over again. Concerns following this practice should have their working stock analyzed before ordering new metal. Electrotype metal becomes rich in tin after successive remeltings.

Electrotype metal is furnished in pig form.

Molding press for use in molding impression lead.

IMPRESSION LEAD

In many electrotyping foundries, impression lead, rather than wax, is used as the molding material for the reproduction of very fine halftones and the plates used in multi-color printing. The use of impression lead obviates imperfections and distortions which frequently occur in wax molding because of dimensional changes in the wax.

National Lead Company manufactures three grades of impression lead: plain impression lead; ready-to-mold impression lead; and tin-coated impression lead.

Plain impression lead is simply a pure grade of lead in sheet form of uniform thickness and softness. Ready-to-mold impression lead is a lead sheet which has been scratch-brushed after rolling and sprinkled with graphite. The protective coating of graphite prepares the surface for the electroplating bath and retards corrosion. Tin-coated impression lead is so made to prevent corrosion.

Impression lead sheets are furnished in any size according to specification. Maximum size sheets measure 24″ x 36″.

ELECTROTYPE CASES

Electrotype cases are lead alloy sheets used by electrotypers for wax molding. They can be supplied ⅛″ thick (or heavier, if desired) and in any width and length specified. One side of the sheets has been wire-brushed to insure close adhesion of the wax. The maximum size for electrotype cases is 22½″ x 33½″.

MUSIC PLATES

Music plates are made of an alloy of lead and used by printers of sheet music. The engraver first rules the plates with a special five-pronged fork and then stamps on the notes with steel dies. A proof is taken and printing plates are made from the proof.

We manufacture music plates in various compositions of tin, lead, antimony and copper. The plates are uniform in thickness and rolled to a high luster. They are rectangular in shape and usually measure 6½″ x 9½″, 8″ x 11″, or 9½″ x 13″. Larger or smaller sizes can also be furnished.

TINT PLATES

Tint plates are used for color work by many large printing houses. They are also used for printing names, trademarks and designs on fabrics by bag companies, cotton mills, etc.

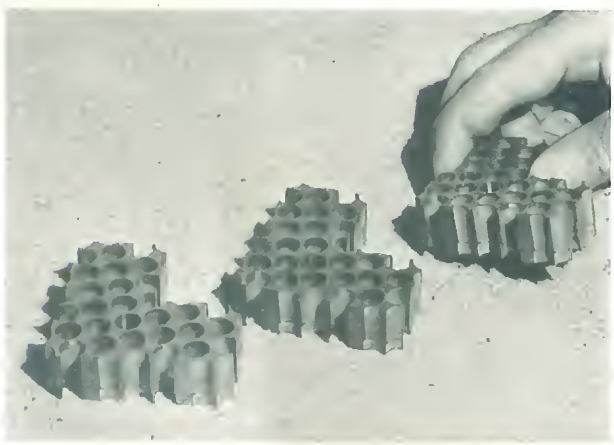
Tint plates are cast from varying proportions of lead, tin and antimony. They are planed on a planer and shaved on one side to a high luster with a shaving knife. Our tint plates are very accurate in measurement. Minimum thickness supplied is .155″; maximum size 22½″ x 33½″. Smaller sizes are furnished on request.

BLATCHFORD PLATE MOUNTING SYSTEM

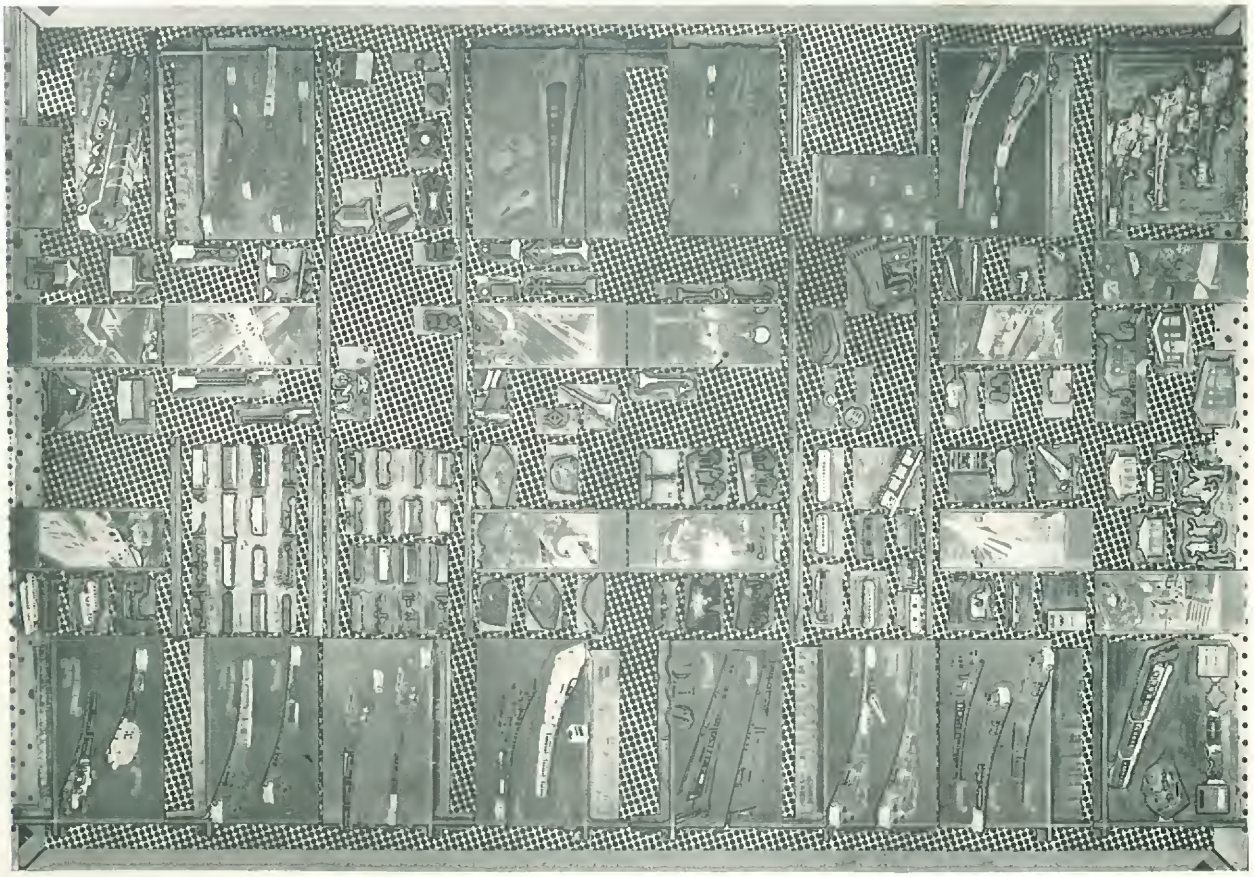
The Blatchford System for mounting printing plates has been scientifically designed and then perfected by printers themselves to meet the requirements of all classes of printing production.

Its advantages are many. It is simple in construction. It provides a uniform support for every square inch of printing surface of every printing plate. Hair line register is obtained with a minimum of time and effort. Plates cannot move on the base during the longest runs once they are properly positioned and locked. By virtue of the unusual shape of the sectional unit, a "straight line of break" is eliminated.

The unit of the Blatchford System is a six-sided, L-shaped section, well-riddled with holes, and the working surface of which is ruled in quarter-inch squares, providing a fractional-inch, rather than a pica, gauge for the make-up man.



Above: *"L" shaped units of the Blatchford base.*
Below: *A fine example of intricate plate mounting by the Steidinger Press of New York City. It is the "red" form of a four-color process job printing on a 46¼" x 70" sheet. There are 121 separate plates in this form. It would have been impossible to mount these plates on any other base with sufficient catches to properly hold and register them.*



Making up the form on a Blatchford base.

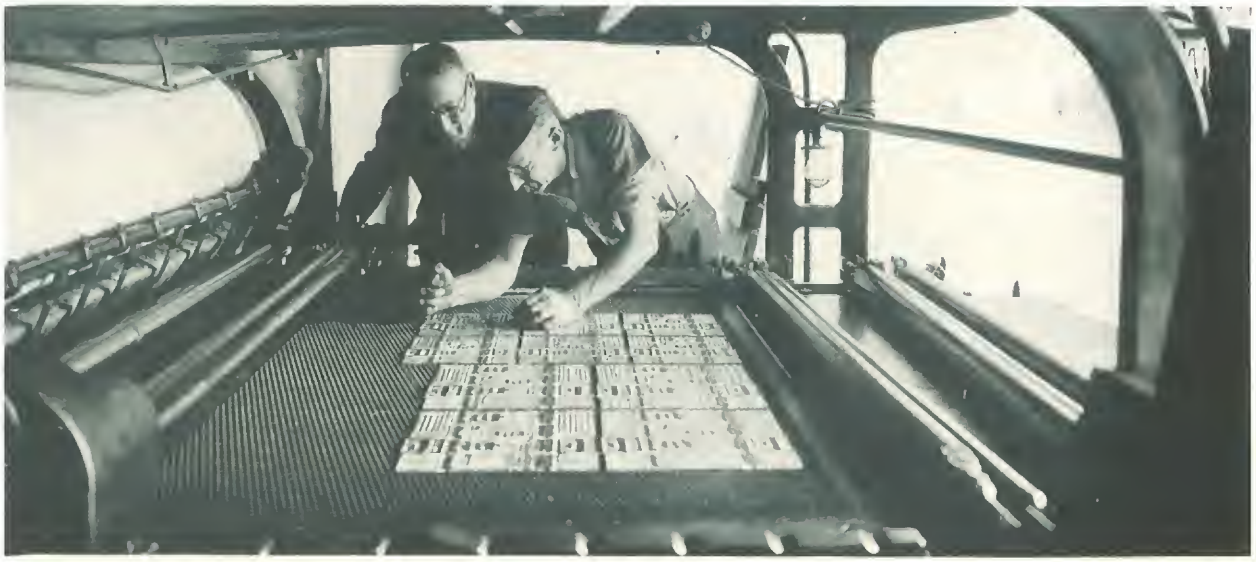
The odd shape of the unit gives the Blatchford System an exclusive advantage: when woven into a form or bed, each unit has six similar units holding it in place—instead of four as with square-shaped sections. By thus eliminating a "straight line of break", there is less possibility of springing or warping a form in lock-up.

Furthermore, there are no restrictions in handling small plates in the Blatchford System. Plates as small as 1¾" x 1¼" or ⅝" x 2" can be registered and locked each with six hooks and with margins of ⅛". A plate as narrow as a 6-point linotype slug can be mounted and supported with a pair of catches opposite each other at 1¼" intervals.

INQUIRIES

Further information about the Blatchford Plate Mounting System will gladly be furnished on request. Address your inquiry to National Lead Company, E. W. Blatchford Co. Branch, 63 Park Row, New York City, or 900 W. 18th St., Chicago.

Registering a Blatchford-mounted form on the press.



GRID METAL

Grid metal is lead hardened with antimony. It is used by battery manufacturers for casting the frames or perforated plates which hold the lead oxides in a storage battery.

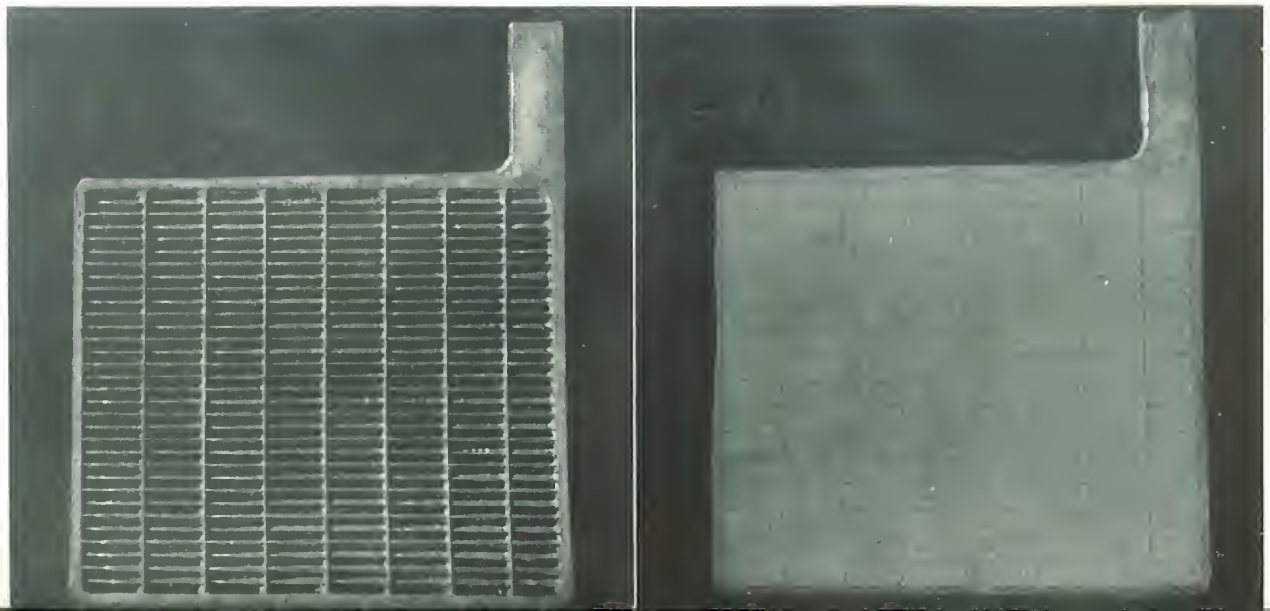
We manufacture grid metal of a uniformly high quality. The purity of the metals used as well as the exactness with which the alloy meets our customer's specification as to antimony content and tolerance of impurities is a primary consideration with our production department. Our grid metal is usually furnished in 60 lb. pigs although lighter weight pigs may be obtained if desired.

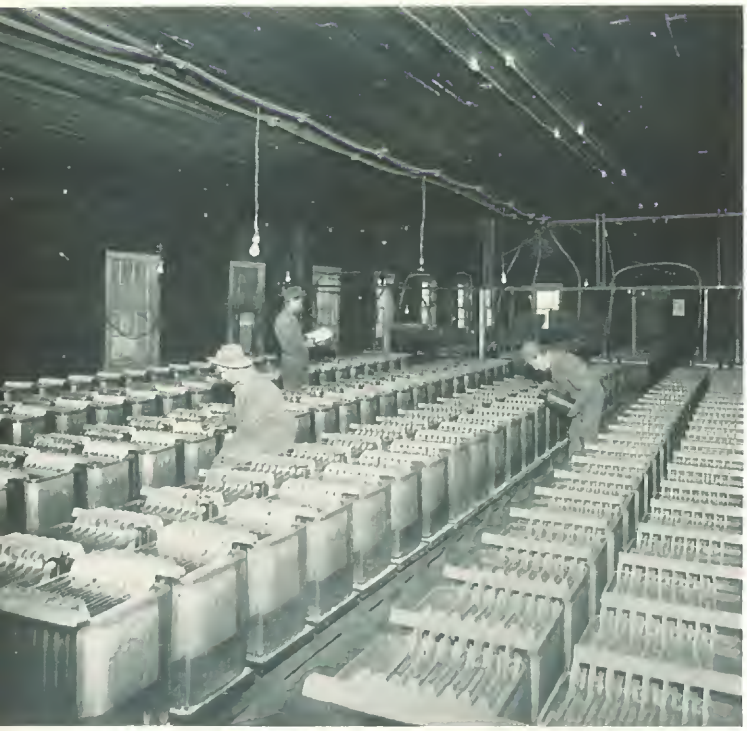
COMPOSITION

The antimony content of grid metal varies from 4% to 12% depending on the type of plate being cast. For automotive battery grids or all other grids which are thin and light in construction, the lead should contain between 9.5% and 12% antimony. An alloy of this composition imparts greater hardness and strength to the plate. At the same time, it facilitates casting because it possesses greater fluidity over a longer temperature range.

For casting heavy duty grids—those intended for farm-lighting, truck and stationary batteries—alloys containing 4% to 6% of antimony are satisfactory. Grids of this type are ordinarily of heavy construction and the usual practice is to cast them by hand rather than in casting machines.

Above: *Storage battery room in a large broadcasting studio. Note the lead grid inside the battery in the foreground.* Below: *Standard type of grid used in the automobile storage battery. The grid at the right is shown after pasting with lead oxide.*





Interior of the storage battery house at a large mine. The workmen are inspecting the batteries and bringing up the acid level in cells where needed.

CASTING TEMPERATURE

A temperature of 800° to 850° F. is a proper one for the machine casting of grids from 9.5-12% antimonial lead. For hand casting, a temperature approximately 50° F. higher may be necessary. The alloys containing 4-6% antimony require a casting temperature of 850° to 900° F.

TREATMENT AND TEMPERATURE OF MOLD

An improper preliminary treatment of the casting molds, or their operation at temperatures which are too high or too low, are frequent causes for defective grids.

The inner surfaces of the molds should first be coated either with a layer of acetylene smoke or a liquid spray compound. A "lubricant" of this latter type is manufactured by National Lead Company and is known as "Molspray."

A temperature of 350° to 450° F., depending upon the grid size and mold construction, is a satisfactory working temperature for machine operated molds. Hand operated molds might require some external heat, especially in the early stages of casting, to attain a good working temperature. Molds which are too hot delay solidification of the metal. Molds which are not hot enough may result in the production of grids with missing ribs.

TREATMENT OF GRIDS

Grids freshly cast—even from 12% antimonial lead—are quite soft. The usual practice is to "age" grids for three to six days before pasting them. This is especially necessary with the thinner grids or those intended for machine pasting. "Aging" is most readily accomplished by allowing the grids to stand at room temperature for the specified period.

GRID METAL SPECIFICATIONS OF VARIOUS BATTERY MANUFACTURERS

Specifications	Manufacturer							
	A	B	C	D	E	F	G	H
Antimony—Nominal	11.5	12.	9.	9.5	10.	9.5	8.	10.
Tin—Minimum	.45	.15	.20	.25	....	.25	.15	.25
Maximum	.55	.25	.30	.50	.40	.50	.45	.40
Arsenic—Minimum	.08	....	....	....	....	.08	....	....
Maximum	.12	.15	.08	.10	.2	.15	.075	.10
Copper—Maximum	.10	.08	.08	.05	.10	.10	.075	.08
Bismuth—Maximum	.005	.05	.05	.05	.025	.005	.005	....
Nickel—Maximum	.01	.01	.01	.0015	....	.01	.005	....
Zinc—Maximum	None	....	.005	.0015	.001	....	.005	....
Silver—Maximum	.0015	.01	....	.0015	....	....	None	....
Iron—Maximum	....	.01	.005	.01	.01	....	.005	....
Sulphur—Maximum	....	.005	....	....	....	....	....	....
Manganese—Maximum	....	....	.005	....	.001	....	....	....
Lead	Balance	Balance	Balance	Balance	Balance	Balance	Balance	Balance

ZINC BASE ALLOYS
for die or slush casting

Zinc base alloys are used by die casters and slush casters in the fabrication of a wide variety of articles for many different purposes. The objects cast range from certain types of tools and machinery parts to household utensils and ornaments. The alloys contain—in addition to zinc—aluminum, copper or magnesium, varied according to the required physical properties of the finished casting. They are superior to many other metals or alloys which might be used for the purpose in several respects.

They have excellent casting qualities and a relatively low casting temperature. Melting between 725°F-800°F according to composition, they flow smoothly and readily and present a good surface finish. They take plated, lacquered or enameled finishes equally well. Their physical strength, exceeding most other soft metal alloys, is ample for practical purposes.

For pressure or die casting, we manufacture four standard alloys which cover a range from maximum physical strength to extreme fluidity. These alloys are designated as 123-X, 124-M, 124-S and 124-C. Their physical properties are indicated on the page that follows. We also produce other alloys, developed by our technical men in collaboration with the manufacturer who may require an alloy of a different composition for a particular type of casting.

For slush casting, we manufacture two standard alloys designated as 126-X and 126-C. The physical properties of these alloys, particularly as regards flow, differ from the physical properties of pressure casting alloys due to the nature of the process. Here the alloy is poured into the mold without pressure. As the alloy in contact with the mold hardens, the latter is inverted and the molten core is poured out leaving a hollow casting.

All our zinc base alloys are guaranteed to be made only from metals of the required purity.

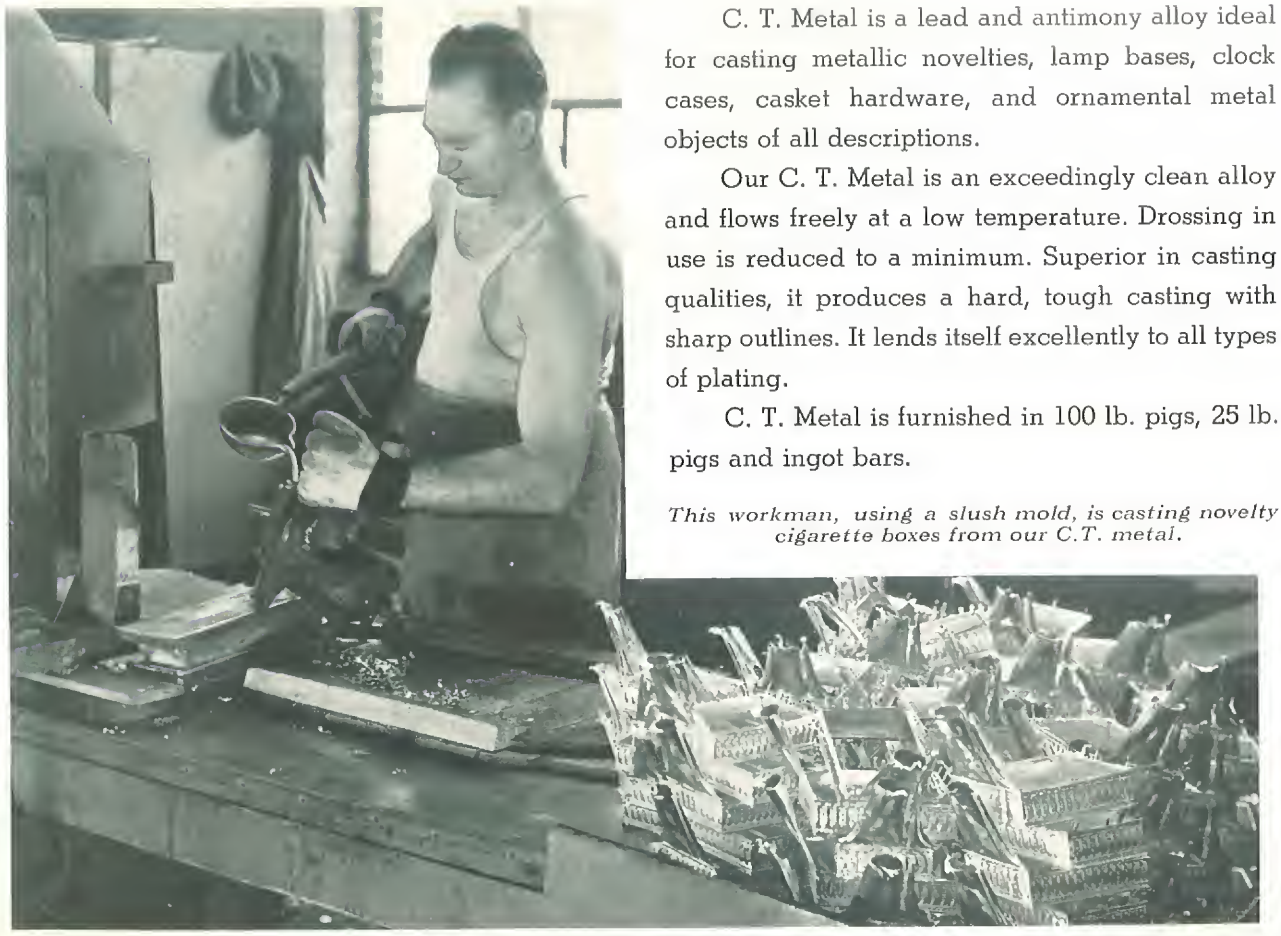
Typical castings made from National Lead Company's die casting alloys. Note the good surface finish of objects above; the intricacy of castings below.

They are skillfully alloyed under ideal foundry conditions, designed to eliminate all danger of contamination thus insuring continued uniformity and strict adherence to the proper and desired chemical composition. The alloys are furnished in 7 lb. bars packed in 500 lb. boxes.

APPROXIMATE DATA ON NATIONAL LEAD COMPANY DIE CASTING ALLOYS

	123-X	124-M	124-S	124-C
Tensile Strength—Lbs./Sq. In.	42,000	33,000	38,000	37,000
Impact Strength (Charpy) as measured on ¼" x ¼" bar	12.00	11.00	14.50	15.00
Elongation—% in 2 Inches	2.5	3.0	3.5	6.0
Compressive Strength—Lbs./Sq. In	93,100	60,500	87,300	91,700
Brinell Hardness	83	62	73	71
Specific Gravity	6.754	6.644	6.675	6.717
Melting Point	734°F.	728°F.	727°F.	732°F.

C. T. METAL



C. T. Metal is a lead and antimony alloy ideal for casting metallic novelties, lamp bases, clock cases, casket hardware, and ornamental metal objects of all descriptions.

Our C. T. Metal is an exceedingly clean alloy and flows freely at a low temperature. Drossing in use is reduced to a minimum. Superior in casting qualities, it produces a hard, tough casting with sharp outlines. It lends itself excellently to all types of plating.

C. T. Metal is furnished in 100 lb. pigs, 25 lb. pigs and ingot bars.

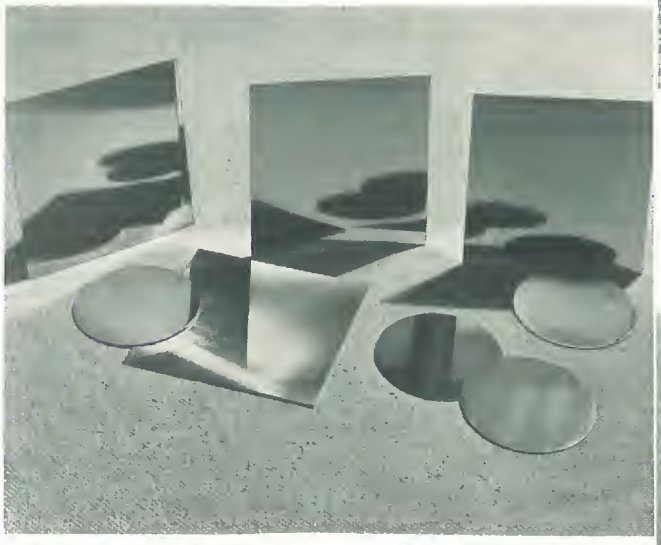
This workman, using a slush mold, is casting novelty cigarette boxes from our C.T. metal.

PEWTER

Pewter—sometimes called Britannia Metal—is a lead-free alloy, composed principally of tin with small amounts of antimony and copper. Considerably harder than pure tin, it is a highly ductile and malleable metal and can be readily fabricated, by casting, drawing, spinning or hand manipulation, into a variety of objects.

Pewter is widely used by manufacturers of flat ware and hollow ware. Because of its easy working qualities, it is also used in large quantities by amateur metal craftsmen and students in art metal courses in schools and colleges.

One of the chief attractions of a fabricated pewter object is its fine appearance. The alloy resembles silver and takes the same high polish, although, having a lower light-reflective property, it has a somewhat darker cast. Pewter articles are hard enough to withstand every-day use without becoming seriously marred or dented.



Pewter is furnished in either rectangular sheets or circular discs. The discs range in diameter from 2″ to 20″ and come in gauges from 14 to 20. Rectangular sheets are obtainable in these same gauges in any size up to 24″ x 36″. A table showing the complete range of gauges and sizes is given on the following page.

Above and Below: *Types of utensils commonly executed in pewter. The punch bowl and ladle above, the work of an amateur metal craftsman, was selected by the American Federation of Arts for exhibition at the e937 World's Exposition in Paris, France.* Left: *Our plwter is supplied in rectangular sheets and discs as shown. Note the high polish.*

SIZES AND WEIGHTS OF PEWTER SHEETS* AND DISCS

Gauge	20 ga.	19 ga.	18 ga.	17 ga.	16 ga.	15 ga.	14 ga.
Thickness	.031 in.	.035 in.	.040 in.	.045 in.	.050 in.	.057 in.	.064 in.
Weight of Discs of Following Diameters							
2 in.	1/3 oz.	2/5 oz.	1/2 oz.	3/5 oz.	2/3 oz.	3/4 oz.	4/5 oz.
3 in.	1 oz.	1 1/10 oz.	1 1/4 oz.	1 2/5 oz.	1 1/2 oz.	1 3/4 oz.	2 oz.
4 in.	1 3/4 oz.	2 oz.	2 1/4 oz.	2 1/2 oz.	2 7/8 oz.	3 1/5 oz.	3 2/3 oz.
5 in.	2 2/3 oz.	3 oz.	3 1/2 oz.	4 oz.	4 1/3 oz.	5 oz.	5 2/3 oz.
6 in.	3 2/3 oz.	4 1/5 oz.	4 3/4 oz.	5 1/3 oz.	6 oz.	6 4/5 oz.	7 3/4 oz.
7 in.	5 1/3 oz.	6 oz.	6 3/4 oz.	7 3/5 oz.	8 1/2 oz.	9 2/3 oz.	11 oz.
8 in.	6 2/3 oz.	7 3/4 oz.	8 3/4 oz.	9 7/8 oz.	11 oz.	12 1/2 oz.	14 1/4 oz.
9 in.	8 1/2 oz.	10 oz.	11 1/4 oz.	12 2/3 oz.	14 oz.	16 1/8 oz.	18 1/4 oz.
10 in.	10 1/4 oz.	11 7/8 oz.	13 1/2 oz.	15 1/8 oz.	16 7/8 oz.	19 1/3 oz.	22 oz.
11 in.	12 1/2 oz.	14 1/2 oz.	16 1/2 oz.	18 1/2 oz.	20 2/3 oz.	23 2/3 oz.	26 7/8 oz.
12 in.	15 oz.	17 1/4 oz.	19 2/3 oz.	22 oz.	24 1/2 oz.	28 1/8 oz.	31 7/8 oz.
13 in.	17 1/2 oz.	20 1/4 oz.	23 oz.	25 7/8 oz.	28 3/4 oz.	33 oz.	37 1/3 oz.
14 in.	20 1/3 oz.	23 1/2 oz.	26 3/4 oz.	30 oz.	33 1/2 oz.	38 1/3 oz.	43 1/2 oz.
15 in.	23 1/3 oz.	27 oz.	30 3/4 oz.	34 1/2 oz.	38 1/2 oz.	44 1/8 oz.	50 oz.
16 in.	26 2/3 oz.	30 7/8 oz.	35 oz.	39 1/3 oz.	43 3/4 oz.	50 1/5 oz.	56 7/8 oz.
17 in.	29 7/8 oz.	34 1/2 oz.	39 1/4 oz.	44 1/8 oz.	49 oz.	56 1/3 oz.	63 3/4 oz.
18 in.	33 2/3 oz.	39 oz.	44 1/4 oz.	49 3/4 oz.	55 1/3 oz.	63 1/2 oz.	72 oz.
19 in.	37 2/5 oz.	43 1/3 oz.	49 1/4 oz.	55 2/5 oz.	61 1/2 oz.	70 2/3 oz.	80 oz.
20 in.	41 1/2 oz.	48 oz.	54 1/2 oz.	61 1/3 oz.	68 1/8 oz.	78 1/4 oz.	88 1/2 oz.
*Weight of Sheets per Sq. Ft.	19 oz.	22 oz.	25 oz.	28 1/8 oz.	31 1/4 oz.	35 7/8 oz.	40 5/8 oz.

When ordering specify quantity of discs or sheets and gauge. Sheets may be ordered any size not exceeding 24" x 36". A price list for pewter sheets and discs will be mailed upon request.

GASKET METAL

Gasket Metal is a special alloy designed for sealing joints in refrigerating machinery, particularly for the joints of compressors where carbon dioxide or some similar gas is used as the refrigerant.

Our special Hoyt No. 8 Gasket Metal was developed by us in close collaboration with the largest manufacturers of refrigerating machinery in the country. Of correct composition, it makes a gasket hard enough to resist compression yet not so hard as to be brittle. Gaskets cut from this metal can be used on either the warm or the cold end of the compressor.

Gasket Metal is furnished in the following thicknesses: .006", .010", .015", and .029". It is packed flat in special boxes to prevent damage in shipment. In ordering this metal, it is a good plan to state size and number of gaskets to be cut. We will then send sheets of a size and shape that will cut with a minimum of waste.

ANTIMONY

Antimony possesses the property of increasing the hardness of metals with which it is alloyed and thus has a wide commercial use. We can furnish pure antimony of any brand desired. It comes in cakes varying from 40 lbs. to 55 lbs. depending upon brand.

SLAB ZINC (Spelter)

Prime zinc after smelting but before refining. Used widely for brazing and galvanizing purposes. We supply this grade of zinc in slabs weighing approximately 60 lbs.

BLOCK TIN PRODUCTS

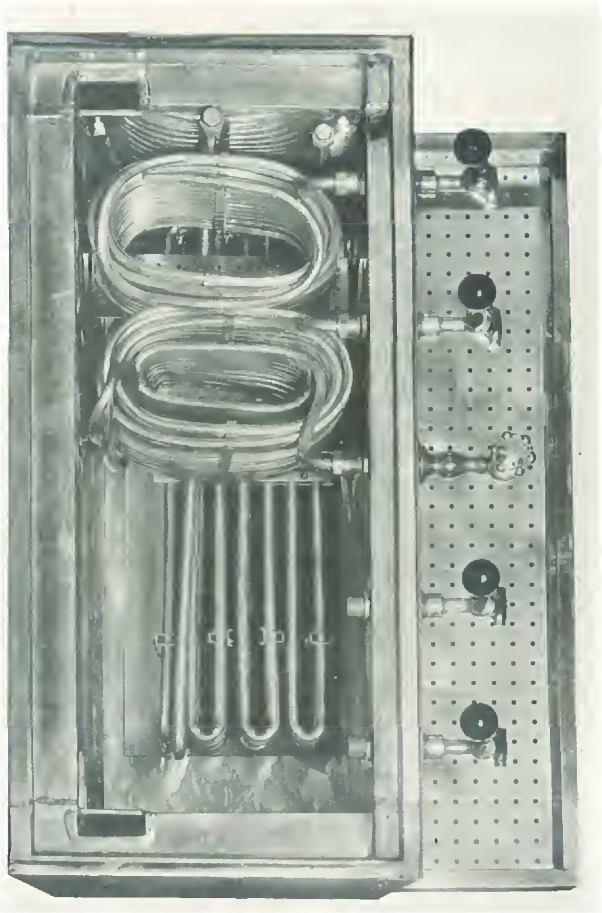
Block tin is a term used in the metal trade to refer to products made wholly from strictly pure high grade tin. As shown on this and the following page, we manufacture a full line of block tin products. All are made from accepted brands of pure, primary metal only.

TIN PIPE

While tin pipe has many and varied uses, its most important applications are in beer dispensing apparatus, soda fountain installations and for all types of equipment handling liquids intended for human consumption. Tin pipe does not rust, tarnish or corrode, and therefore does not contaminate most of the liquids regularly passed through it. The ease with which tin pipe can be bent or coiled is an additional advantage in this connection.

We manufacture tin pipe in a variety of sizes and weights. A selected list is given below. Other sizes and weights can be furnished on short notice. Our tin pipe can be depended upon to be uniform in wall thickness and free from hard and soft spots or other imperfections.

Block tin pipe is supplied in straight lengths, on coils or on reels as specified on the order.



Beer dispensing unit with the top removed to show block tin pipe cooling coils.

SIZES AND WEIGHTS OF BLOCK TIN PIPE

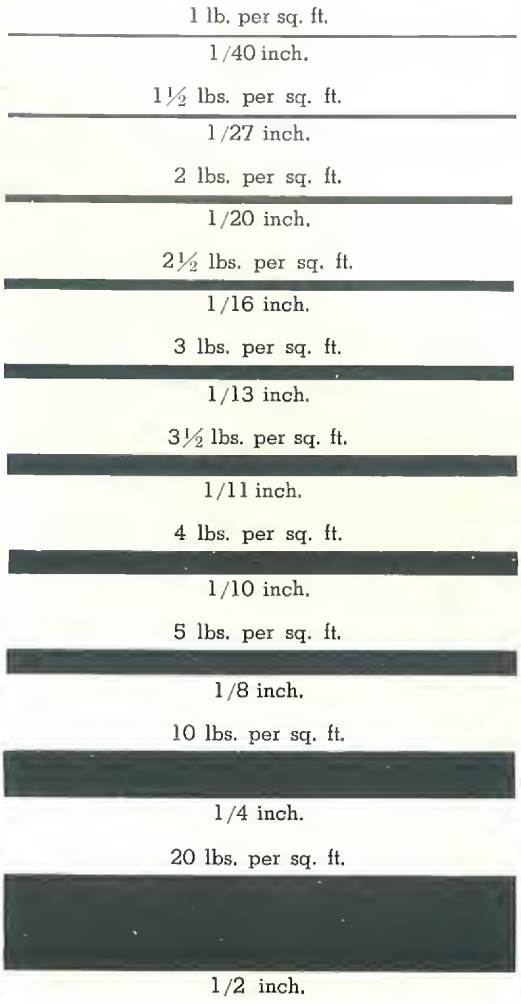
I. D. (Inches)	O. D. (Inches)	Appr. Wgt. in Ozs. Per Ft.	I. D. (Inches)	O. D. (Inches)	Appr. Wgt. in Ozs. Per Ft.	I. D. (Inches)	O. D. (Inches)	Appr. Wgt. in Ozs. Per Ft.
3/16	1/4	1 1/2	3/8	9/16	6 1/2	1/2	3/4	12 1/2
3/16	5/16	2 1/2	3/8	9/16	7 1/2	5/8	3/4	7
1/4	3/8	3	3/8	19/32	8 1/2	5/8	25/32	9
1/4	13/32	4	3/8	5/8	9 1/2	5/8	13/16	10 1/2
1/4	7/16	5	3/8	5/8	10 1/2	5/8	7/8	15
1/4	15/32	6	3/8	21/32	12	3/4	7/8	8
1/4	1/2	7	7/16	9/16	4 1/2	3/4	29/32	10
1/4	1/2	8	7/16	5/8	8	3/4	29/32	11
5/16	7/16	4	1/2	19/32	4	3/4	15/16	12 1/2
5/16	1/2	5 1/2	1/2	5/8	5	3/4	1	17
5/16	17/32	7 1/2	1/2	5/8	5 1/2	3/4	1 1/32	20
3/8	1/2	4	1/2	21/32	7	3/4	1 1/16	22 1/2
3/8	1/2	4 1/2	1/2	21/32	7 1/2	1	1 3/16	16
3/8	1/2	5	1/2	11/16	9	1	1 3/16	17
3/8	17/32	5 1/2	1/2	23/32	10 1/2	1	1 7/32	19 1/2

TIN SHEET

Tin in sheet form is used extensively by soda tank manufacturers and as the lining material in tanks and vats employed in the preparation and handling of drugs, food products and various chemicals. Tin sheet does not corrode nor does it contaminate substances in contact with it. It is easily worked and thus easy to install.

We manufacture sheet tin by a milling process from specially refined, primary metal. It can be supplied in practically any thickness and size up to a width of 8 feet. Small size sheets are shipped flat and carefully packed to avoid damage. Large size sheets are shipped on rolls.

SIZES AND WEIGHTS OF SHEET TIN



TIN ANODES

Our tin anodes are made from the highest grade, refined metal only. Highly polished and free from imperfections, they provide uniform distribution in the acid bath and wear down evenly.

Anodes are supplied in any size and shape specified in the order. They are carefully packed for protection in shipping.

TIN WIRE

An important use for tin wire is in spray guns for the application of metallic coatings. We can supply pure refined tin wire for this and other purposes in all standard wire gauges.

TIN TAPE

Tin tape is an extruded product and can be furnished in practically any width and thickness desired. It is furnished on spools or reels according to the weight of the shipment or the specification of the purchaser.

PULVERIZED TIN

Pulverized or powdered tin is used principally for the pre-tinning operation in delicate soldering work. We furnish pulverized tin in three meshes—50, 100 and 200. It is packed in tins or bulk containers.

BAR TIN

We furnish pure refined tin cast in bar form. These bars, which weigh approximately 1 lb. each, are widely used by plumbers for enriching solder. They are carefully packed in boxes of any weight desired by the customer.

INGOT TIN

Pure refined tin is also obtainable in rectangular ingot form. Each ingot weighs approximately 5 lbs.

PIG TIN

We also supply pure tin cast in pig form for large users. Pigs weigh approximately 100 lbs.

DUTCH BOY PAINT MATERIALS

In addition to the metal products shown in this catalog, National Lead Company sells a full line of paint materials. These products—all carrying the Dutch Boy trademark—are described and illustrated on this and the following page.

THE DUTCH BOY LINE

The basic materials in the Dutch Boy line are white-lead and red-lead. White-lead is sold in paste form and reduced to painting consistency by the painter. It can be used for all coats on nearly all surfaces—interior or exterior. Red-lead is sold in either paste or liquid form. It is intended primarily for the protection of exterior or interior metal surfaces.

Pure white-lead and pure red-lead paints have been used for generations. Their durability and economy are matters of record. Today, they are the paints which are most often used or specified by painting contractors, engineers, architects and others whose business it is to know the facts about paint.

Complementing white-lead and red-lead in the line are products designed for use with these basic materials—linseed oil, Lead Mixing Oil, colors in oil, liquid drier—and wall primer, a special first-coater for interior porous surfaces.

PAINT INFORMATION SERVICE

National Lead Company's Department of Technical Paint Service is ready at all times to answer any question you may have pertaining to paint or its application. Your inquiry addressed to that Department will receive prompt attention.

DUTCH BOY WHITE-LEAD

Dutch Boy white-lead is available in two forms—heavy paste and soft paste. The two are identical in quality and make the same amount of paint. Soft paste, however, contains a small quantity of turpentine. It can be reduced to painting consistency more quickly.

Both forms of white-lead can be used for all jobs—interior as well as exterior—and for all finishes—flat, eggshell or gloss. They are sold in 100 lb. steel kegs; 50, 25 and 12½ lb. steel pails; and 1 and 5 lb. tins.

Two types of linseed oil are sold under the Dutch Boy trademark—raw and boiled. The raw oil is a carefully filtered oil obtained from the finest grade of flaxseed. Boiled oil is raw oil which has been heated and to which metallic compounds have been added to bring about quicker drying. Both types of linseed oil are sold in 1-gallon and 5-gallon factory-sealed cans.

DUTCH BOY LINSEED OIL

DUTCH BOY LEAD MIXING OIL

Dutch Boy Lead Mixing Oil is a companion vehicle to Dutch Boy linseed oil. It was developed for a special purpose—to provide an oil which would mix perfectly with white-lead for the sealing and decoration of porous surfaces, interior or exterior. Paint made with it dries to a practically flat finish which can be washed readily and as often as necessary.

Dutch Boy Lead Mixing Oil is sold in factory-sealed 1-gallon and 5-gallon cans.

DUTCH BOY COLORS IN OIL

Dutch Boy colors in oil are specially made for tinting white-lead paint. They come in a soft paste form and can be readily mixed into the paint without thinning. Dutch Boy colors in oil are sold in 1-gallon, 1-quart and ½-pint cans and 2-ounce tubes.

DUTCH BOY WALL PRIMER

Dutch Boy wall primer is a sealer and a paint coat combined. It is used for priming unusually porous plaster or wall board. It stops suction effectively and hides discolored spots and smudgy surfaces. Dutch Boy wall primer makes a perfect foundation for later coats of white-lead paint. It is sold in 1-quart and 1-gallon cans and 5-gallon kits.

DUTCH BOY LIQUID DRIER

Dutch Boy liquid drier is a strong, dependable drier made especially for use with white-lead paint. It is a properly-balanced material designed to bring about a uniform, efficient drying action. It is sold in 1-gallon, 1-quart, 1-pint and ½-pint cans.

DUTCH BOY RED-LEAD

Dutch Boy red-lead is available in several forms: Paste Red-lead; Liquid Red-lead No. 1 (Orange Red); Liquid Red-lead No. 6 (Light Brown); Liquid Red-lead No. 7 (Dark Brown); Liquid Red-lead No. 5 (Black); and Quick-Drying Red-lead. (Orange Red.)

CHEMICALS WITH WHICH LEAD IS USED

The following is a partial list of the chemicals with which lead is commonly used in the process industries. It is offered as a general guide only. Because of the wide variation in operating conditions and the broad range of chemicals and combinations of chemicals used in modern industry, a more complete and more specific list would be impractical.

We welcome inquiries concerning the use of lead in chemical equipment. A complete report as to operating conditions and the nature of the reacting substances will enable us to determine the suitability of lead for your particular purpose.

ACETIC ACID. Concentrated or glacial acid may be used with lead and is commonly stored in lead vessels. Dilute acid will dissolve lead in the presence of oxygen.

ACETONE. Used satisfactorily with lead.

ALCOHOL, ETHYL or METHYL. Used satisfactorily with lead.

ALUMINUM SULPHATE (or Alum). Can be used freely with all kinds of lead equipment. Hard lead i.e. antimonial lead is often used.

AMMONIA. Lead is not affected by dry ammonia free from metallic sodium or potassium.

AMMONIUM HYDROXIDE. As vapor or liquid, can be used satisfactorily with lead at practically all temperatures or concentrations.

AMMONIUM CHLORIDE. In concentrations of around 10%, may be used satisfactorily at ordinary temperatures. At elevated temperatures and where the concentration is more than 10%, some corrosion will take place.

AMMONIUM PHOSPHATE. Can be used satisfactorily with lead.

AMMONIUM SULPHATE. Used freely in all types of lead equipment.

ANTIMONY CHLORIDE. Lead has been used with comparative economy for chlorinating the trichloride to the pentachloride.

BENZYL CHLORIDE. Can be used satisfactorily with lead.

BLEACHING SOLUTION (Hydrogen Peroxide). Lead is widely used, particularly antimonial lead.

BLEACHING SOLUTION (Sodium Hypochlorite). Corrodes lead.

BORIC ACID. Lead is widely used in its manufacture.

BRINE. (See Sodium Chloride).

BROMINE. Used with lead when cold and acid-free.

CALCIUM CARBONATE. Occurs in natural waters and forms a good protective coating on lead pipe.

CALCIUM HYDROXIDE (Lime). Is used in small amounts to correct the solvent action of some very soft waters on lead pipe. It is recommended that water so treated should not exceed an alkalinity of pH9.

CARBON DIOXIDE. Is usually a protective influence in natural waters, except when there is a very high content as in certain ground waters. Lead is also used in acid-carbonate systems of generating CO_2.

CARBON TETRACHLORIDE. Finds use at ordinary temperatures.

CHLORINE. Does not attect lead if dry. Moist chlorine may be used with lead up to about 105–110°C with slight corrosion.

CHLORINATED HYDROCARBONS. Have varying action on lead, from slight to severe, depending on breakdown to HCl and presence of organic acids.

CHLORINATION PROCESSES. Lead equipment is used with comparative economy in most cases. While slowly corroded at the temperatures usually found, lead will give as satisfactory a life as other common metals and with greater economy.

CHROMIC ACID. Is used with lead in fairly high strengths. Antimonial lead is usually preferred in electroplating. Chromates form a good protective coating on lead.

COAL TAR. Refining and recovery of many by-products.

CONCRETE (Cement or Mortar). Fresh lime in concrete or mortar will attack lead forming a reddish corrosion product which does not protect the lead. Aging of all concrete or an application of tar or asphalt is recommended, before contact with lead.

COPPER SULPHATE. Is used with lead. The lead is used either for anodes or as a lining for tanks for electroplating from sulphate solutions.

ETHER MANUFACTURE.

FORMALDEHYDE (or Formic Acid). Attacks lead about like acetic acid.

HYDROCHLORIC ACID. Lead is not generally recommended for commercial use of this acid, but has been used with some attendant corrosion in acid concentrations up to 30% at room temperature, or in acid concentrations up to 20% at 100°C. A 12% antimonial lead is usually preferred over ordinary lead or one of lower antimony content. This holds for many chlorination processes. Lead is also quite frequently used where vapors are allowed to escape to the open air from reaction vessels.

HYDROFLUORIC ACID. Lead has fair resistance to dilute solutions of this acid. It is commonly used.

HYDROGEN CHLORIDE (Anhydrous Hydrochloric Acid). Has little effect on lead.

HYDROGEN PEROXIDE. Will not corrode lead severely alone, but accelerates all acid corrosion by its presence.

LITHOPONE MANUFACTURE.

MAGNESIUM CHLORIDE. Is corrosive to lead as it is to other metals.

NAPHTHALENE. Can be used with lead equipment.

NITRIC ACID. While lead nitrate is too soluble to recommend lead for nitric acid in general, concentrated acid of over 80% strength can be handled with very little corrosion. Dilute strengths are too corrosive. Mixed acid (sulphuric and nitric) may be used at ordinary temperature if the water present is under 30%. At higher temperatures the mixture becomes much more corrosive. At a certain combination known as nitrosyl-sulphuric acid when a small amount of nitric acid is present in concentrated sulphuric at elevated temperature, the combination is kept at its least corrosive condition in the chamber process for making sulphuric acid by careful control. Sulphate salts are considered inhibitors to corrosion by nitric acid.

NITROBENZOL or NITROCHLORBENZOL. Are considered corrosive to lead.

NITROCELLULOSE. (See Rayon).

NITROGLYCERINE. Lead is used for handling spent acids from the manufacture of this explosive and in the rayon industry for nitrocellulose.

ORGANIC ACIDS. Dilute organic acids in general tend to accelerate the corrosion of lead and solutions containing them should be questioned as to their effect. We will be glad to have you consult us in regard to sulphuric acid or other solutions containing such acids, since lead can be used effectively in some cases.

OXYGEN. Dry gas has no effect on lead other than a tarnish. In the presence of water an initial attack occurs, usually followed by a good protective coating by action of salts dissolved in natural waters such as carbonates, sulphates and silicates. In the absence of any protective salts, oxygen may well be removed by aeration on account of its action on all metals, particularly the hot water piping.

PHENOL. Can be used satisfactorily with lead.

PHOSPHORIC ACID. May be used with lead up to a strength of 80% below 200°C with only slight corrosion. Impurities in very small amounts decrease the corrosive effect markedly and impure acid is used up to 85% concentration.

PHOTOGRAPHIC SOLUTIONS. May be used with lead.

POTASSIUM PERMANGANATE. Will attack lead.

PYRIDENE. Has practically no effect on lead.

RAYON. Lead is used in all processes of manufacture.

SILICATES. Sodium silicate forms a good protective coating on lead in small amounts in natural waters and is to be recommended if treatment is necessary.

SOAP MANUFACTURE.

SODIUM CARBONATE. Forms a protective coating in natural waters. Dilute solutions have no effect on lead.

SODIUM CHLORIDE. May be used in dilute solutions under 100°C. Sea water or brine is commonly handled in antimonial lead.

SODIUM HYPOSULPHITE. Can be handled in lead.

SODIUM HYDROXIDE. Is somewhat corrosive but can be recommended at strengths up to 25% under 80°C, where its attack is slight.

SODIUM SULPHATE SOLUTIONS. Can be used freely with lead.

SODIUM SULPHIDE SOLUTIONS. May be used up to 100°C.

SODIUM SULPHITE SOLUTIONS. Are used up to about 20% concentration at ordinary temperatures.

SOILS. While soils vary in corrosive properties, the average type corrodes lead very little. Lead pipe is very widely used as service pipe and underground cable covering.

SULPHONATING PROCESSES.

SULPHUR DIOXIDE. Has little effect when dry and can be used moist up to about 200°C with lead.

SULPHUR TRIOXIDE. Can be used satisfactorily with lead.

SULPHURIC ACID. Lead is the favorite material for this acid in all its ramifications throughout the industry. It resists all concentrations up to 96% at room temperature, and up to about 85% at all temperatures up to about 220°C. For some purposes at even higher temperatures, up to 250°C, lead or lead-lined equipment will have comparatively good life. For the more drastic temperatures, tellurium lead is commonly used. For boiling acid stronger than 85% (or about 63.5°Be) cast iron is usually recommended although lead will handle this strength easily at room temperatures.

SULPHUROUS ACID. Can be used freely up to about 220°C.

TANNIC ACID. Is somewhat similar to acetic acid.

TARTARIC ACID. Is somewhat similar to acetic acid.

THIONYL CHLORIDE. Can be used freely with lead up to about 220°C, and in some instances higher.

TITANIUM SULPHATE SOLUTIONS. Can be used satisfactorily with lead.

WATER, DISTILLED. Attacks lead very slowly in proportion to the amount of dissolved oxygen contained.

WATER, NATURAL. Usually has no corrosive attack on lead due to small amounts of dissolved salts which form a protective coating. Sometimes very soft waters or those having an origin from peaty sources containing organic acids have slight solvent action. This may be corrected by small additions of sodium silicate or lime. Waters particularly high in chlorides, so as to contain the chlorides of calcium and magnesium, are somewhat corrosive to all common metals.

WOODS. Seasoned wood has practically no corrosive effect on lead. A few cases of certain woods containing organic acids, such as green oak, have been reported as corrosive to lead. Insect damage from larvae maturing in the wood has also been reported, and all wood to be lined with lead should be carefully inspected for the presence of borers, etc.

ZINC CHLORIDE. Can be used satisfactorily with lead.

DATA RELATIVE TO CHEMICAL LEAD PIPES FOR HEATING COILS

Inside Diameter of Pipe in Inches	Maximum Steam Pressure Lbs. per Sq. In.	Corresponding Temperature in °F.	Pipe Classification	Pipe Outside Diameter in Inches	Weight per Ft. Lbs. Ozs.	Sq. Ft. Surface Area per 100 Ft. Length
¾	30	274	C	1.006	1 – 12	26.3
¾	40	287	A	1.156	3 –	30.3
¾	50	298	AA	1.212	3 – 8	31.75
1	30	274	B	1.356	3 – 4	35.5
1	40	287	AA	1.492	4 – 12	39.05
1	50	298	Special	1.61	6 – 2	42.15
1¼	30	274	A	1.67	4 – 12	43.7
1¼	40	287	AAA	1.889	7 – 12	49.4
1¼	50	298	Special	2.012	9 – 10	52.65

SAFE WORKING PRESSURES

For Calculating Safe Working Pressure of Pipe at Various Temperatures

Temperature °C.	Temperature °F.	Equivalent Steam Gauge Pressure Lbs. per Sq. In.	Maximum Allowable Fiber Stress in Lbs. per Sq. In. Tellurium or Chemical Lead	Maximum Allowable Fiber Stress in Lbs. per Sq. In. 6% Antimonial Lead
20	68	..	200	400
30	86	..	190	370
40	104	..	180	340
50	122	..	172	310
60	140	..	162	280
70	158	..	153	254
80	176	..	144	222
90	194	..	136	195
100	212	0	127	165
110	230	6	118	137
120	248	14	110	110
130	266	24	100	80
140	284	37	90	50
150	302	54	80	..
247	477	535	..	0
327	621	..	0	..

The formulas to be used with the above values are:

$$P=\frac{2\,ST}{D} \text{ or } T=\frac{PD}{2S}$$

Where P is the safe working pressure in lbs. per sq. inch
S is the maximum allowable fiber stress from above table
T is thickness of pipe wall in inches
D is internal diameter in inches.

Sometimes it is advisable to use wall thicknesses greater than those derived from the above equation for mechanical or structural reasons. Where corrosion is anticipated, it is well to provide additional wall thickness.

HEATING COIL FORMULA

For Calculating Length of Lead Pipe Needed for Heating Solutions—Time 1 hour

$$\text{Mean temperature difference °F.} = \frac{(T-T_1)-(T-T_2)}{2.3\log_{10}\frac{(T-T_1)}{(T-T_2)}}$$

where T = Temperature of steam or heating medium in °F.
T_1 = Initial temperature of solution in °F.
T_2 = Final temperature of solution in °F.

$$\text{Length of pipe required} = \frac{V\times W\times(T_2-T_1)\times Sp\times 12}{H\times M\times D\times 3.1416}$$

where V = Volume of solution in gallons
W = Weight of solution in lbs. per gal.
T_2 = Temperature to which solution is to be heated in °F.
T_1 = Initial temperature of solution in °F.
Sp = Specific heat of solution
H = Heat transfer in B.t.u./sq. ft./°F./hr. = 150
M = Mean temperature difference °F.
D = Outside diameter of lead pipe in inches

NOTE: H varies with the thermal conductivity of the solution, the density of the solution and the amount of stirring. As a general figure H = 150 when convection currents function well or there is mild stirring. For a more thorough consideration of heat transfer problems, engineering books on the subject should be consulted.

TEMPERATURE CONVERSION

From Fahrenheit to Centigrade—Subtract 32, multiply by five-ninths.

From Centigrade to Fahrenheit—Multiply by nine-fifths, add 32.

DENSITY DATA FOR LEAD, TIN AND THEIR ALLOYS

Metal	Density (Water—1)	Wt. in Lbs. per Cu. In.	Wt. in Lbs. per Cu. Ft.	Metal	Density (Water—1)	Wt. in Lbs. per Cu. In.	Wt. in Lbs. per Cu. Ft.
Lead	11.36	.410	708	45% Tin 55% Lead	9.10	.328	567
Tin	7.30	.264	453	50% Tin 50% Lead	8.89	.321	555
5% Tin 95% Lead	11.00	.397	686	55% Tin 45% Lead	8.70	.314	542
10% Tin 90% Lead	10.70	.386	667	60% Tin 40% Lead	8.50	.3058	528
25% Tin 75% Lead	9.95	.359	620	6% Antimony 94% Lead	10.88	.392	679
30% Tin 70% Lead	9.70	.350	605	8% Antimony 92% Lead	10.74	.388	674
35% Tin 65% Lead	9.50	.343	593	10% Antimony 90% Lead	10.59	.382	664
40% Tin 60% Lead	9.30	.336	581	12% Antimony 88% Lead	10.52	.380	655

MINIMUM WEIGHTS RECOMMENDED FOR SOIL, WASTE, VENT OR FLUSH PIPES, BENDS AND TRAPS

Internal Diameter Inches	Weight per Foot Lbs.	Oz.	Internal Diameter Inches	Weight per Foot Lbs.	Oz.
1	2	..	2	4	12
1¼	2	8	3	6	..
1½	3	8	4	7	14

FLOW OF WATER IN HOUSE SERVICE PIPES

*(in cu. ft. per min.)**
Thomson Meter Co.

Conditions of Discharge	Pressure in Main Lbs. per Sq. In.	Nominal Diameters of Lead Service Pipe in Inches ½″	⅝″	¾″	1″	1½″	2″
Through 35′ of Service Pipe, No Back Pressure	30	1.10	1.92	3.01	6.13	16.58	33.34
	40	1.27	2.22	3.48	7.08	19.14	38.50
	50	1.42	2.48	3.89	7.92	21.40	43.04
	60	1.56	2.71	4.26	8.67	23.44	47.15
	75	1.74	3.03	4.77	9.70	26.21	52.71
	100	2.01	3.50	5.50	11.20	30.27	60.87
	130	2.29	3.99	6.28	12.77	34.51	69.40
Through 100′ of Service Pipe, No Back Pressure	30	0.66	1.16	1.84	3.78	10.40	21.30
	40	0.77	1.34	2.12	4.36	12.01	24.59
	50	0.86	1.50	2.37	4.88	13.43	27.50
	60	0.94	1.65	2.60	5.34	14.71	30.12
	75	1.05	1.84	2.91	5.97	16.45	33.68
	100	1.22	2.13	3.36	6.90	18.99	38.89
	130	1.39	2.42	3.83	7.86	21.66	44.34
Through 100′ of Service Pipe and 15′ Vertical Rise	30	0.55	0.96	1.52	3.11	8.57	17.55
	40	0.66	1.15	1.81	3.72	10.24	20.95
	50	0.75	1.31	2.06	4.24	11.67	23.87
	60	0.83	1.45	2.29	4.70	12.94	26.48
	75	0.94	1.64	2.59	5.32	14.64	29.96
	100	1.10	1.92	3.02	6.21	17.10	35.00
	130	1.26	2.20	3.48	7.14	19.66	40.23
Through 100′ of Service Pipe and 30′ Vertical Rise	30	0.44	0.77	1.22	2.50	6.80	14.11
	40	0.55	0.97	1.53	3.15	8.68	17.79
	50	0.65	1.14	1.79	3.69	10.16	20.82
	60	0.73	1.28	2.02	4.15	11.45	23.47
	75	0.84	1.47	2.32	4.77	13.15	26.95
	100	1.00	1.74	2.75	5.65	15.58	31.93
	130	1.15	2.02	3.19	6.55	18.07	37.02

NOTE: In this table it is assumed that the pipe is straight and smooth inside, that the friction of the main and meter are disregarded, that the inlet from the main is of ordinary character, sharp, not flaring or rounded, and that the outlet is the full diameter of the pipe. The exact details of the conditions given are rarely met in practice, consequently the quantities of the table may be expected to be decreased, because bends may interpose, or stop-cocks may be used, or back pressure may be increased, etc.

*To find the discharge in gallons, multiply by 7.48.

PHYSICAL PROPERTIES OF LEAD

Atomic number	82
Atomic weight	207.22
Density—20°C., cast	11.35
327.4°C., solid	11.005
327.4°C., liquid	10.686
550°C., liquid	10.418
Atomic volume	18.27
Melting point, °C.	327.4
Boiling point °C., at 760 mm. pressure	1525-1620
Specific heat, per °C., cal per g.	0.030
Latent heat of fusion, cal per g.	5.47-6.26
Coef. of linear expansion (17-100°C.), per °C.	0.0000293
Thermal conductivity, cal./cm.^{2}/cm./°C./sec. at room temperature	0.083
Electrical resistivity, microhm/cm.	20.65
Modulus of elasticity in tension	0.8-2.0 million

PHYSICAL PROPERTIES OF TIN

Atomic number	50
Atomic weight	118.7
Density—20°C., cast	7.29
Atomic volume	16.23
Melting point, °C.	232
Boiling point °C., at 760 mm. pressure	2260
Specific heat, per °C., cal per g.	0.054
Latent heat of fusion, cal per g.	14.4
Coef. of linear expansion (17-100°C.), per °C.	0.000023
Thermal conductivity, cal./cm.^{2}/cm./°C./sec. at room temperature	0.157
Electrical resistivity, microhm/cm	11.5
Modulus of elasticity in tension	5.9-7.8 million

PHYSICAL PROPERTIES OF ZINC

Atomic number	30
Atomic weight	65.38
Density—20°C., cast	7.14
Melting point °C.	419.4
Boiling point °C., at 760 mm pressure	905
Coef. of linear expansion (17-100°C.), per C	0.000033
Thermal conductivity, cal./cm.^{2}/cm./°C./sec.	0.268
Electrical resistivity, microhm/cm	6.0
Color	Bluish White
Character	Brittle at ordinary temperatures Malleable at 100°C. (212°F.)

PHYSICAL PROPERTIES OF ANTIMONY

Atomic number	51
Atomic weight	121.76
Density	6.62
Melting point °C.	630
Boiling point °C., at 760 mm pressure	1380
Coef. of linear expansion (17-100°C.), per °C.	0.0000113
Thermal conductivity, cal./cm.^{2}/cm./°C./sec.	0.50
Electrical resistivity, microhm/cm.	2.67
Color	Blue-white
Character	Brittle

PHYSICAL PROPERTIES OF COPPER

Atomic number	29
Atomic weight	63.57
Density—20°C.	8.94
Melting point, °C.	1083
Boiling point, °C. at 760 mm. pressure	2325
Specific heat, per °C., cal. per g.	0.0919
Latent heat of fusion, cal. per g.	50.46
Electrical resistivity, microhm /cm.	1.682
Thermal conductivity, cal. /cm.^{2} /cm. /sec. /°C.	0.923

PHYSICAL PROPERTIES OF METALS

Metal and Chemical Symbol	Density	Wt. Lbs. Per Cu. In.	Coefficient of Linear Expansion per °F. at Room Temperature	Melting Points		Boiling Points at 760 mm. Pressure	
				°Fahr.	°Cent.	°Fahr.	°Cent.
Aluminum, pure (Al)	2.70	.0975	.0000133	1220	660	3272	1800
Antimony (Sb)	6.620	.2391	.00000627	1166	630	2516	1380
Arsenic (As)	5.73	.2070	.00000214	*1497	*814	*1139	*615
Bismuth (Bi)	9.80	.3541	.00000747	520	271	2642	1450
Brass, (67 Cu, 33 Zn)	8.47	.3060	.0000106	1670-1706	910-930	....	....
Brass, (80 Cu, 20 Zn)	8.62	.3113	.0000100	1769-1814	965-990	....	....
Cadmium, cast (Cd)	8.64	.3125	.0000166	610	321	1403	762
Calcium (Ca)	1.55	.0560	.0000139	1564	851	2522	1383
Chromium (Cr)	7.138	.2579	.0000047	3326	1830	3992	2200
Cobalt (Co)	8.9	.3216	.0000067	2696	1480	5252	2900
Copper, cold-rolled	8.94	.323	.0000093	1981	1083	4217	2325
Gold, pure, cast (Au)	19.3	.6973	.0000080	1945	1063	4712	2600
Iridium (Ir)	22.4	.809	.0000037	4449	2454	8670	4799
Iron, pure (Fe)	7.9	.2853	.0000066	2795	1535	5430	3000
Iron, cast, 4% Carbon	7.03	.2538	.0000066	2102	1150	....	....
Lead, cast (Pb)	11.35	.409	.0000164	621	327	2948	1620
Lead, rolled	11.37	.410	.0000164	621	327	2948	1620
Magnesium (Mg)	1.74	.0628	.0000143	1204	651	2007	1097
Manganese (Mn)	7.2	.260	.0000128	2273	1245	3452	1900
Mercury (Hg)	13.546	.489	.....	−38.0	−39	674	357
Nickel, cast (Ni)	8.85	.320	.0000073	2645	1452	5252	2900
Platinum (Pt)	21.45	.774	.0000051	3224	1773	7772	4300
Potassium (K)	0.86	.031	.000046	144.1	62	1400	760
Silver, pure (Ag)	10.5	.38	.0000105	1761	960	3542	1950
Sodium (Na)	0.97	.035	.0000395	207.5	97.5	1616	880
Steel, soft, .1% Carbon	7.87	.2843	.0000066	2642	1450	5430	3000
Tellurium (Te)	6.24	.224	.0000093	846	452	2534	1390
Tin, cast (Sn)	7.29	.2633	.00001112	450	232	4100	2260
Titanium (Ti)	4.5	.163	.00000396	3272	1800	5432	3000
Tungsten (W)	19.3	.698	.0000022	6098	3370	10652	5900
Zinc, cast (Zn)	7.14	.258	.0000183	787	419	1661	905

*Under pressure. Sublimes without melting at ordinary pressure.

THERMAL DATA FOR COMMON METALS AND ALLOYS*

Metal	Mean Specific Heat 60°F. to M.P., B.t.u. per Lb. per °F.	Heat in Solid at Melting Temp., B.t.u. per Lb.	Latent Heat of Fusion, B.t.u. per Lb.	Total Heat in Liquid at Melting Temp., B.t.u. per Lb.	Mean Specific Heat of Liquid B.t.u. per Lb. per °F.	Average Pouring Temperature °F.	Total Heat in Liquid at Pouring Temp., B.t.u. per Lb.
Aluminum	0.248	286.4	169.1	455.5	0.252	1380	497.1
Antimony	0.054	59.7	70.0	129.7	0.054	1320	138.0
Bismuth	0.033	15.1	18.5	33.6	0.035	620	37.2
Cadmium	0.058	37.4	19.5	56.9	0.074	750	67.3
Copper	0.104	199.9	90.8	290.7	0.111	2200	314.9
Lead	0.032	18.0	9.9	27.9	0.032	720	31.1
Tin	0.069	26.9	24.9	51.8	0.060	650	63.8
Zinc†	0.101	73.	44.	117.	0.122	900	131.
Alloys	**Composition**						
Babbitt							
Lead Base:	75 Pb, 15 Sb, 10 Sn	0.039	15.8	26.2	42.0	0.038	625	48.2
Tin Base:	83.3 Sn, 8.4 Sb, 8.3 Cu	0.071	28.6	34.1	62.7	0.063	916	91.2
Die Casting							
Zinc Base:	95.86 Zn, 4.1 Al, 0.04 Mg†	0.105	69.	49.	118.	0.127	770	131.
Tin Base:	90 Sn, 4.5 Cu, 5.5 Sb	0.070	27.6	30.3	57.9	0.062	650	70.3
Lead Base:	80 Pb, 10 Sn, 10 Sb	0.038	20.5	17.4	37.9	0.037	820	46.0
Aluminum:	92 Al, 8 Cu	0.236	257.3	163.1	420.4	0.241	1400	480.8
Linotype:	86 Pb, 11 Sb, 3 Sn	0.036	15.3	21.5	36.8	0.036	620	41.6
Low Melting Point Metals							
Lipowitz:	26 Pb, 13 Sn, 10 Cd, 51 Bi	0.041	3.3	17.2	20.5	0.041	190	22.6
Wood's:	26 Pb, 13 Sn, 12 Cd, 49 Bi	0.041	4.0	17.2	21.2	0.042	210	23.4
Rose's:	28 Pb, 25 Sn, 50 Bi	0.043	7.3	18.3	25.6	0.041	330	29.7
Plumbers' Solder:	50 Pb, 50 Sn	0.051	18.1	23.0	41.1	0.046	500	45.1
Stereotype:	82 Pb, 15 Sb, 3 Sn	0.036	15.5	26.2	41.7	0.036	620	46.4

*From Industrial Gas Series, "Combustion" 3rd Edition, Am. Gas Assn. †Data revised by National Lead Company.

PHYSICAL PROPERTIES OF CAST LEAD-ANTIMONY ALLOYS

Antimony %	Liquidus °F.	Brinell Hardness No.	Density	Tensile Strength Lbs. per Sq. In.	Elongation %
0	621	4.0	11.35	1780	80
1	612	7.0	11.26	3400	16
2	601	8.0	11.18	4200	16
3	586	9.1	11.10	4700	15
4	572	10.1	11.03	5660	22
5	559	11.0	10.95	6360	29
6	545	11.8	10.88	6840	24
7	531	12.5	10.81	7180	21
8	518	13.3	10.74	7420	19
9	505	14.0	10.66	7580	17
10	495	14.6	10.59	7670	15
11	486	14.8	10.52	7620	13
12	479	15.0	10.45	7480	12
12.5	477	15.1	10.42	7380	11
13	484	15.2	10.38	7280	10
14	496	15.3	10.30	7000	9

IMAL EQUIVALENTS

Fraction	Decimal	Fraction	Decimal	Fraction	Decimal
17/64	.265625	33/64	.515625	49/64	.765625
9/32	.28125	17/32	.53125	25/32	.78125
19/64	.296875	35/64	.546875	51/64	.796875
5/16	.3125	9/16	.5625	13/16	.8125
21/64	.328125	37/64	.578125	53/64	.828125
11/32	.34375	19/32	.59375	27/32	.84375
23/64	.359375	39/64	.609375	55/64	.859375
3/8	.375	5/8	.625	7/8	.875
25/64	.390625	41/64	.640625	57/64	.890625
13/32	.40625	21/32	.65625	29/32	.90625
27/64	.421875	43/64	.671875	59/64	.921875
7/16	.4375	11/16	.6875	15/16	.9375
29/64	.453125	45/64	.703125	61/64	.953125
15/32	.46875	23/32	.71875	31/32	.96875
31/64	.484375	47/64	.734375	63/64	.984375
1/2	.5	3/4	.75	1	1.

IMAL EQUIVALENTS—OUNCES AND POUNDS

Ounces	Pounds	Ounces	Pounds	Ounces	Pounds	Ounces	Pounds
2½	= .15625	5½	= .3438	8½	= .5313	14	= .875
3	= .1875	6	= .375	9	= .5625	15	= .9375
3½	= .21875	6½	= .4063	10	= .625	16	= 1.
4	= .25	7	= .4375	11	= .6875		
4½	= .2813	7½	= .4688	12	= .75		
5	= .3125	8	= .5	13	= .8125		

OF GAUGES

American or Brown & Sharpe	United States Standard	No.	Birmingham or Stubs	American or Brown & Sharpe	United States Standard
....	....	16	.065	.05082	.0625
....	....	17	.058	.04525	.05625
....	....	18	.049	.04030	.05
....	.5	19	.042	.03589	.04375
....	.46875	20	.035	.03196	.0375
....	.4375	21	.0315	.02846	.034375
.460	.40625	22	.028	.025347	.03125
.40964	.375	23	.025	.022571	.028125
.3648	.34375	24	.022	.0201	.025
.32486	.3125	25	.020	.0179	.021875
.28930	.28125	26	.018	.01594	.01875
.25763	.265625	27	.016	.014195	.0171875
.22942	.25	28	.014	.012641	.015625
.20431	.234375	29	.013	.011257	.0140625
.18194	.21875	30	.012	.010025	.0125
.16202	.203125	31	.010	.008928	.0109375
.14428	.1875	32	.009	.00795	.01015625
.12849	.171875	33	.008	.00708	.009375
.11443	.15625	34	.007	.00603	.00859375
.10189	.140625	35	.005	.00561	.0078125
.09074	.125	36	.004	.005	00703125
.08081	.109375	37	....	.00445	.006640625
.07196	.09375	38	....	.003965	00625
.06408	.078125	39	....	.003531	.....
.05707	.0703125	40	....	.003144	.....

DOMESTIC WEIGHTS AND MEASURES

AVOIRDUPOIS WEIGHT

437½ grains	=	1 ounce
16 ounces	=	1 pound
25 pounds	=	1 quarter
4 quarters	=	1 cwt.
20 cwt.	=	1 ton
2240 pounds	=	1 long ton

APOTHECARIES' WEIGHT

20 grains	=	1 scruple
3 scruples	=	1 dram
8 drams	=	1 ounce
12 ounces	=	1 pound

TROY WEIGHT

24 grains	=	1 pennyweight
20 pwt.	=	1 ounce
12 ounces	=	1 pound

DRY MEASURE

2 pints	=	1 quart
8 quarts	=	1 peck
4 pecks	=	1 bushel
36 bushels	=	1 chaldron

LIQUID MEASURE

4 gills	=	1 pint
2 pints	=	1 quart
4 quarts	=	1 gallon
31½ gallons	=	1 barrel
2 barrels	=	1 hogshead

LINEAR MEASURE

12 inches	=	1 foot
3 feet	=	1 yard
5½ yards	= 16½ feet =	1 rod
320 rods	= 5280 feet =	1 statute mile
6080.20 feet	=	1 nautical mile

SURFACE MEASURE

144 sq. inches	=	1 sq. foot
9 sq. feet	=	1 sq. yard
30¼ sq. yards	=	1 sq. rod
160 sq. rods	=	1 acre
640 acres	=	1 sq. mile
1 acre	=	43,560 sq. ft.

CUBIC OR SOLID MEASURE

1728 cu. inches	=	1 cu. foot
27 cu. feet	=	1 cu. yard
128 cu. feet	=	1 cord
40 cu. feet	=	1 ton of ship cargo

METRIC WEIGHTS AND MEASURES

Metric weights and measures form a decimal system based upon the meter.

For convenience, the liter is used as the unit of capacity, and the gram as the unit of weight.

The liter equals one cubic decimeter.

The gram is the weight of one cubic centimeter of water at its greatest density.

Parts and multiples of the unit are indicated by the following prefixes.

Milli (m)	meaning	1/1000
Centi (c)	"	1/100
Deci (d)	"	1/10
Deka (dk)	"	10
Hecto (H)	"	100
Kilo (K)	"	1,000
Myria		10,000

VOLUMES

Cone or pyramid = area of base × ⅓ altitude.
Sphere = cube of diameter × .5236

AREAS

Circle = square of diameter × .7854
Sector of a circle = length of arc × half the radius.
Segment of a circle = area of sector of equal arc, diminished when segment is less than a semicircle, increased when segment is greater than a semicircle, by the area of the triangle formed by two radii of the circle and the chord of the segment.
Triangle = ½ base × altitude.
Parallelogram = base × altitude.
Trapezium = sum of areas of its two triangles.
Trapezoid = ½ sum of parallel sides × altitude.
Regular polygon = ½ perimeter × perpendicular from center to a side.
Ellipse = long diameter × short diameter × .7854
Surface of sphere = square of diameter × 3.1416

COMPARISONS

U. S. bushel	=	2150.42 cu. inches	
Br. Imp. bushel	=	2218.2 cu. inches	
U. S. gallon	=	231 cu. inches	
7.481 U. S. gallons	=	1 cu. foot	
6.229 Br. Imp. gallons	=	1 cu. foot	
6 U. S. gallons	=	5 Br. Imp. gallons	
1 cord	=	about 103 bushels	
1 meter	= 39.37 in.	(U. S. Statute)	
1 liter	= 61.022 cu. in.	" "	
1 gram	= 15.42 grains	" "	
25.4 mm.	=	1 inch	
30.48 cm.	=	1 foot	
1 meter	=	3.281 feet	
1.6093 kilometer	=	1 mile	
6.4515 sq. cm.	=	1 sq. inch	
1 sq. meter	=	10.764 sq. ft.	
1 sq. meter	=	1,550 sq. inches	
1 cu. meter	=	264.2 U. S. gallons	
1 kilogram	=	2.2046 pounds	
1,000 kilograms	=	1 metric ton	
1 kg. per sq. cm.	=	14.223 lbs. per sq. inch	

DIAMETERS, CIRCUMFERENCES AND AREAS OF CIRCLES IN INCHES

including contents in gallons at one foot in depth.

Diameter Inches	Circum. Inches	Area Sq. Ins.	Gallons 1 Ft. Depth	Diameter Inches	Circum. Inches	Area Sq. Ins.	Gallons 1 Ft. Depth
1 in.	3.1416	.7854	.04084	6½	20.420	33.183	1.72552
⅛	3.5343	.9940	.05169	⅝	20.813	34.471	1.79249
¼	3.9270	1.2271	.06380	¾	21.205	35.784	1.86077
⅜	4.3197	1.4848	.07717	⅞	21.598	37.122	1.93034
½	4.7124	1.7671	.09188	7 in.	21.991	38.484	2.00117
⅝	5.1051	2.0739	.10784	⅛	22.383	39.871	2.07329
¾	5.4978	2.4052	.12506	¼	22.776	41.282	2.14666
⅞	5.8905	2.7611	.14357	⅜	23.169	42.718	2.22134
2 in.	6.2832	3.1416	.16333	½	23.562	44.178	2.29726
⅛	6.6759	3.5465	.18439	⅝	23.954	45.663	2.37448
¼	7.0686	3.9760	.20675	¾	24.347	47.173	2.45299
⅜	7.4613	4.4302	.23036	⅞	24.740	48.707	2.53276
½	7.8540	4.9087	.25522	8 in.	25.132	50.265	2.61378
⅝	8.2467	5.4119	.28142	⅛	25.515	51.848	2.69609
¾	8.6394	5.9395	.30883	¼	25.918	53.456	2.77971
⅞	9.0321	6.4918	.33753	⅜	26.310	55.088	2.86458
3 in.	9.4248	7.0686	.36754	½	26.703	56.745	2.95074
⅛	9.8175	7.6699	.39879	⅝	27.096	58.426	3.03815
¼	10.210	8.2957	.43134	¾	27.489	60.132	3.12686
⅜	10.602	8.9462	.46519	⅞	27.881	61.862	3.21682
½	10.995	9.6211	.50029	9 in.	28.274	63.617	3.30408
⅝	11.388	10.320	.53664	⅛	28.667	65.396	3.40059
¾	11.781	11.044	.57429	¼	29.059	67.200	3.49440
⅞	12.173	11.793	.61324	⅜	29.452	69.029	3.58951
4 in.	12.566	12.566	.65343	½	29.845	70.882	3.68586
⅛	12.959	13.364	.69493	⅝	30.237	72.759	3.78347
¼	13.351	14.186	.73767	¾	30.630	74.662	3.88242
⅜	13.744	15.033	.78172	⅞	31.023	76.588	3.98258
½	14.137	15.904	.82701	10 in.	31.416	78.540	4.08408
⅝	14.529	16.800	.87360	⅛	31.808	80.515	4.18678
¾	14.922	17.720	.92144	¼	32.201	82.516	4.29083
⅞	15.315	18.665	.97058	⅜	32.594	84.540	4.39608
5 in.	15.708	19.635	1.02102	½	32.986	86.590	4.50268
⅛	16.100	20.629	1.07271	⅝	33.379	88.664	4.61053
¼	16.493	21.647	1.12564	¾	33.772	90.762	4.71962
⅜	16.886	22.690	1.17988	⅞	34.164	92.885	4.82846
½	17.278	23.758	1.23542	11 in.	34.557	95.033	4.94172
⅝	17.671	24.850	1.29220	⅛	34.950	97.205	5.05466
¾	18.064	25.967	1.35028	¼	35.343	99.402	5.16890
⅞	18.457	27.108	1.40962	⅜	35.735	101.623	5.28439
6 in.	18.849	28.274	1.47025	½	36.128	103.869	5.40119
⅛	19.242	29.464	1.53213	⅝	36.521	106.139	5.51923
¼	19.635	30.679	1.59531	¾	36.913	108.434	5.63857
⅜	20.027	31.919	1.65979	⅞	37.306	110.753	5.75916

These tables are theoretically correct, but variations must be expected in practice.

DIAMETERS, CIRCUMFERENCES AND AREAS OF CIRCLES IN FEET

including contents in gallons at one foot in depth.

Diameter Ft. In.	Circum. Ft. In.	Area Sq. Ft.	Gallons 1 Ft. Depth	Diameter Ft. In.	Circum. Ft. In.	Area Sq. Ft.	Gallons 1 Ft. Depth
1	3 1⅝	.7854	5.8735	4 8	14 7⅞	17.1041	127.9112
1 1	3 4⅜	.9217	6.8928	4 9	14 11	17.7205	132.5209
1 2	3 8	1.0690	7.9944	4 10	15 2⅛	18.3476	137.2105
1 3	3 11	1.2271	9.1766	4 11	15 5¼	18.9858	142.0582
1 4	4 2⅛	1.3962	10.4413	5	15 8½	19.6350	146.8384
1 5	4 5⅜	1.5761	11.7866	5 1	15 11⅝	20.2947	151.7718
1 6	4 8½	1.7671	13.2150	5 2	16 2¾	20.9656	156.7891
1 7	4 11⅝	1.9689	14.7241	5 3	16 5¾	21.6475	161.8886
1 8	5 2¾	2.1816	16.3148	5 4	16 9	22.3400	167.0674
1 9	5 5⅞	2.4052	17.9870	5 5	17 0⅛	23.0437	172.3300
1 10	5 9	2.6398	19.7414	5 6	17 3¼	23.7583	177.6740
1 11	6 2¼	2.8852	21.4830	5 7	17 6⅜	24.4835	183.0973
2	6 3⅜	3.1416	23.4940	5 8	17 9⅝	25.2199	188.6045
2 1	6 6½	3.4087	25.4916	5 9	18 0¾	25.9672	194.1930
2 2	6 9⅝	3.6869	27.5720	5 10	18 3⅞	26.7251	199.8610
2 3	7 0¾	3.9760	29.7340	5 11	18 7⅛	27.4943	205.6133
2 4	7 3⅞	4.2760	32.6976	6	18 10⅛	28.2744	211.4472
2 5	7 7	4.5869	34.3027	6 3	19 7½	30.6796	229.4342
2 6	7 10¼	4.9087	36.7092	6 6	20 4⅞	33.1831	248.1564
2 7	8 1⅜	5.2413	39.1964	6 9	21 2⅜	35.7847	267.6122
2 8	8 4½	5.5850	41.7668	7	21 11⅞	38.4846	287.8230
2 9	8 7⅝	5.9395	44.4179	7 3	22 9¼	41.2825	308.7270
2 10	8 10¾	6.3049	47.1505	7 6	23 6¾	44.1787	330.3859
2 11	9 1⅞	6.6813	49.9654	7 9	24 4⅛	47.1730	352.7665
3	9 5	7.0686	52.8618	8	25 1½	50.2656	375.9062
3 1	9 8¼	7.4666	55.8382	8 3	25 11	53.4562	399.7668
3 2	9 11⅜	7.8757	58.8976	8 6	26 8⅜	56.7451	424.3625
3 3	10 2½	8.2957	62.0386	8 9	27 5¾	60.1321	449.2118
3 4	10 5⅝	8.7265	65.2602	9	28 3¼	63.6174	475.7563
3 5	10 8¾	9.1683	68.5193	9 3	29 0⅝	67.2007	502.5536
3 6	10 11⅞	9.6211	73.1504	9 6	29 10⅛	70.8823	530.0861
3 7	11 3	10.0846	75.4166	9 9	30 7½	74.6620	558.3522
3 8	11 6⅛	10.5591	78.9652	10	31 5	78.5400	587.3534
3 9	11 9⅜	11.0446	82.5959	10 3	32 2⅜	82.5160	617.0876
3 10	12 0½	11.5409	86.3074	10 6	32 11¾	86.5903	647.5568
3 11	12 3⅝	12.0481	90.1004	10 9	33 9¼	90.7627	678.2797
4	12 6¾	12.5664	93.9754	11	34 6⅝	95.0334	710.6977
4 1	12 9⅞	13.0952	97.9310	11 3	35 4⅛	99.4021	743.3686
4 2	13 1	13.6353	101.9701	11 6	36 1½	103.8691	776.7746
4 3	13 4⅛	14.1862	103.0300	11 9	36 10⅞	108.4342	810.9143
4 4	13 7¼	14.7479	110.2907	12	37 8⅜	113.0976	848.1890
4 5	13 10½	15.3206	114.5735	12 3	38 5¾	117.8590	881.3966
4 6	14 1⅜	15.9043	118.9386	12 6	39 3¼	122.7187	917.7395
4 7	14 4⅝	16.4986	123.3830	12 9	40 0⅝	127.6765	954.8159

These tables are theoretically correct, but variations must be expected in practice.

PRODUCTS OF NATIONAL LEAD COMPANY

PRODUCTS OF THE METAL DIVISION

SHEET LEAD

Antimonial
Chemical
Common
Crawlproof
Tellurium
Tellurium-Antimonial
Special Alloy

LEAD PIPE

Antimonial
Chemical
Common
Tellurium
Tellurium-Antimonial
Special Alloy

FITTINGS, PUMPS, VALVES

Bends, Lead or Lead Alloy
Bends and Ferrules, Combination
Cocks, Antimonial Lead Plug
Ferrules, Combination
Fittings, Cast Antimonial Lead
Pumps, Antimonial Lead
Soldering Nipples, Combination
Traps, Lead or Lead Alloy
Valves, Antimonial Lead

LINED OR COVERED PRODUCTS

Acid Recovery Equipment
Bars, Lead-Covered Steel
Chemical Apparatus, Lead-Lined
Coils, Lead-Lined Copper
Lead-Covered Copper
Tin-Lined Copper
Tin-Covered Copper
Fittings, Lead- or Tin-Lined
Impellers, Lead- or Tin-Covered
Pipe, Lead-Lined Iron, Brass, Copper or Steel
Lead-Covered Iron, Brass, Copper or Steel
Tin-Lined Iron, Brass, Copper or Steel
Tin-Covered Iron, Brass, Copper or Steel
Tin-Lined Lead
Pumps, Tin-Lined Lead
Sheets, Lead-Covered Steel
Tank Cars, Lead-Lined
Tank Connections, Lead- or Tin-Lined or Covered
Tanks, Lead- or Tin-Lined
Valves, Lead- or Tin-Lined
Wire, Lead-Covered Iron, Copper or Monel

BEARING METAL

Dutch Boy and Hoyt Brands
Special Shapes
Special Composition

SOLDER

Dutch Boy Brands
Rosin and Acid Core
Special Shapes
Special Composition

CINCH ANCHORING SYSTEM

Expansion Bolts

BLATCHFORD PLATE MOUNTING SYSTEM

HOMOGENEOUS LEAD EQUIPMENT

See Lined or Covered Products

TYPE METALS

Combination Metal
Linotype—Intertype
Ludlow
Monotype
Sorts Caster
Stereotype—Autoplate
Special Mixtures

MISCELLANEOUS PRODUCTS

Alloys, Lead, Tin or Zinc Base
Aluminum Solder
Anodes, Lead, Tin or Special Alloy
Antimony
Antimonial Lead
Balls, Lead
Bars, Lead or Tin
Battery Straps
Bearings
Bearing Plates, Lead
Bottles, Lead
Britannia Metal
Burning Bar
Came Lead
Castings, Special
Caulking Lead
Chemical Lead
C. T. Metal
Coils, Lead, Tin or Special Alloy
Common Lead
Electrotype Cases
Electrotype Metal
Extruded Shapes, Special
Fuse Wire
Gaskets, Lead
Gasket Metal
Glazier's Lead
Grid Metal
Guards, Metal
Hammer Metal
Hammers, Lead or Babbitt
Hardening Lead
Impression Lead
Ingot Lead
Leads, Printers'
Music Plates
Needle Metal
Net Leads
Organ Pipe Metal
Ornaments, Lead
Pewter
Phosphor Tin
Pig Lead
Pig Tin
Pinking Blocks
Pipe, Tin
Plates, Lead
Pulverized Tin or Lead
Ribbon, Tin or Lead
Roof Flanges
Roofing Washers
Sash Weights, Lead
Screens, Lead
Sheet Tin
Shredded Lead
Sinkers, Lead
Sleeving, Lead
Shot, Lead
Sounding Leads
Spacers, Lead
Spelter
Stamping Metal
Tellurium Lead
Tellurium-Antimonial Lead
Tint Plates
Tubing, Lead, Tin or Special Alloy
Washers, Lead
Wedge Lead
Weights, Miscellaneous Lead
White Copper Stamping Metal
Wire, Lead, Tin or Special Alloy
Wool, Lead

OTHER PRODUCTS

Acetate of Lead
Barium Sulphate
Barytes
Basic Lead Chromate
Basic Lead Sulphate
Carbide
Castor Oil
Colors, Dry and in Oil
Drier, Liquid
Flake White
Flatting Oil
Flaxseed, Ground, Meal or Cake
Hyposulphite of Lead
Lead Mixing Oil
Linseed Cake
Linseed Oil
Litharge
Liquid Lead
Orange Mineral
Red-Lead
Red-Lead Paint
Titanium Pigments
Wall Primer
White-Lead

INDEX

KEY TO INDEX—The material in this catalog is divided into twenty-one sections. Each section is identified by a letter which appears at the top of every page near the inner margin. The sections are in alphabetical order.

Products and other items are indexed by letter and number. The letter indicates the section. The number indicates the page in that section.

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